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COMBINED ALTERNATIVES ANALYSIS REPORT NORTHSIDE SANITARY LANDFILL AND ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION

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EXECUTIVE SUMMARY

INTRODUCTION

This Combined Alternative Analysis (CAA) report discusses the study methods used in developing and evaluating remedial action alternatives for the Environmental Conservation and Chemical Corporation (ECC) site and the Northside Sanitary Landfill (NSL) site. The alternatives developed in this report are derived from the alternatives developed for the individual sites and discussed in the ECC and NSL Feasibility Study (FS) reports. The purpose of combined alternatives for the adjacent sites is to ensure the remedial actions are compatible with each other, to avoid duplicate remedial actions, and to integrate remedial actions to achieve cost savings. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 104(d)(4) states that sites geographically close or posing similar threats to the public health, welfare, and the environment may be treated as one site.

The U.S. Environmental Protection Agency (EPA) uses this report to recommend a cost-effective remedial action alternative for the sites in accordance with the National Oil and Hazardous Substances Contingency Plan (NCP) (February 18, 1986). Section 300.68(i) of the NCP states the appropriate extent of remedy is defined as a "cost effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment."

The CAA report is based on information contained in the following reports:

- Final ECC Remedial Investigation (RI) Report, March 14, 1986
- Final NSL RI Report, March 27, 1986
- Public Comment ECC FS Report November 7, 1986
- Public Comment NSL FS Report November 7, 1986

SITE BACKGROUND

The ECC and NSL sites are next to each other in a rural area of Boone County, Indiana, near the intersection of State Route 32 and U.S. Highway 421 and about 10 miles northwest of Indianapolis. The ECC site occupies 6.5 acres immediately west of the 168-acre NSL site, of which approximately 70 acres is landfilled.

NSL is a privately owned and operated active solid waste disposal facility. The site has been active since at least 1962 and has accepted various industrial and municipal wastes during the course of its operation. The vice president of NSL has estimated 16 million gallons of hazardous wastes have been disposed of in the landfill. A 3-acre oil separation lagoon on the landfill surface is evident in a 1977 aerial photograph. The site has had recurring operational deficiencies as reported by the Indiana State Board of Health (ISBH). The EPA detected leachate running into Finley Creek, and groundwater contamination was detected in monitoring wells at the site. The site was placed on the National Priorities List in 1983.

ECC began operations in 1977 and was engaged in the recovery/reclamation/brokering of primary solvents, oils, and other wastes received from industrial clients. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Reclamation processes included distillation, evaporation, and fractionation to reclaim solvents and oil.

Several memorandums from ISBH discuss the disposal of ECC wastes in the NSL landfill. ECC wastes reportedly disposed of at NSL were 5,000 gallons/month of wastewater from the ECC oil reclamation process, still bottoms and solvent recovery waste, 50 to 80 drums/day of paint sludge, thinner, stain and resin sludge, and at least 7,000 drums of unreported contents.

Drum shipments to ECC were halted in February 1982 after EPA and ISBH investigations showed accumulation of contaminated stormwater onsite, inadequate management of drum inventory, and several spill incidents. In 1983 ECC was placed on the National Priorities List (NPL) of hazardous waste sites. EPA subsequently conducted removal actions at ECC including removal, treatment, and disposal of cooling pond waters, about 30,000 drums of waste, 220,000 gallons of hazardous waste from tanks, and 5,650 cubic yards of contaminated soil and cooling pond sludge.

SITE DESCRIPTION

The area surrounding the sites is largely undeveloped. Land use to the east and south of the site is agricultural, to the west and north it is residential. Approximately 50 residences are within 1 mile of the site.

An unnamed drainage ditch that separates NSL from the ECC site flows into Finley Creek near the southwest corner of the landfill. Finley Creek discharges into Eagle Creek about one-half mile downstream of the site. Eagle Creek then flows south for about 9 miles before emptying into the Eagle Creek Reservoir, which is used by the City of Indianapolis for a portion of its drinking water supply.

RESULTS OF REMEDIAL INVESTIGATIONS

Remedial investigations including soil, hydrogeologic, surface water, and sediment investigations of the sites began in 1983 and continued to November 1985. Details of the investigations are included in the ECC and NSL Remedial Investigation Reports.

ECC SITE

Soil contaminants found onsite were primarily volatile organic compounds (VOC's) and phthalates. Migration of VOC's in the soil to the shallow saturated silty clay zone has occurred onsite. The shallow sand and gravel deposit (approximately 18 feet below ground surface) has also been found to be contaminated with VOC's though the source may have been a former cooling pond onsite rather than downward migration from the shallow saturated zone. Organic contaminants were also found in Finley Creek immediately downstream of the site.

Under existing site conditions, the VOC's and certain phthalates will tend to leach from subsurface soil into the groundwater and slowly migrate to the unnamed ditch or Finley Creek downgradient of the site. Once in the surface waters, contaminants will either volatilize, adsorb to sediment, or experience dilutions on the order of 20 to 1 before reaching the downstream Eagle Creek Reservoir.

NSL SITE

Soil contaminants found in peripheral subsurface soils were primarily organic and inorganic compounds. The sand and gravel lens near the surface in the southwest corner of the site (the lens constitutes the shallow sand and gravel deposit beneath the ECC site) has also been found to be contaminated with VOC's. Organic contaminants were also found in Finley Creek immediately downstream of the site.

Specific contaminant types and quantities disposed of at the NSL site are largely unknown. Data are also unavailable to locate the burial areas within the 70-acre landfill with the exception of the oil separation lagoon.

Since contamination within the landfill cannot be quantified, it is not possible to estimate future releases of contaminants nor the resulting effects on the surrounding environment. Over time, contaminants at the site perimeter would be expected to increase to a maximum level and then decrease to background concentrations. It is possible that if contaminant types or levels increase, the time period before which concentrations permanently decrease to nonhazardous levels may be 100 years or longer.

ENDANGERMENT ASSESSMENT RESULTS

The endangerment assessment found that under the no action alternative potential unacceptable risks to human health and the environment exist at the ECC and NSL sites. These risks are summarized in Table 1.

The exposure pathway potentially affecting the largest number of people is release of contaminants to Finley Creek from groundwater or landfill leachate and their subsequent transport to Eagle Creek Reservoir. Current contaminant concentrations measured in groundwater and in Finley Creek do not result in levels posing a threat to human health when they reach the drinking water intake of the reservoir. This is based on the evaluation of contaminant concentrations assuming dilution only. Further reductions in concentrations would be expected from volatilization, adsorption, and degradation. Contaminant concentrations in groundwater and in Finley Creek, however, could increase in the future either as a result of contaminant migration from source areas or as a result of new contaminants created in degradation processes. It is possible that threats to human health could occur in the future for the population served by the Eagle Creek Reservoir.

ASSEMBLY OF REMEDIAL ACTION ALTERNATIVES

Remedial action goals were developed to address the site problems identified in the endangerment assessment.

With these goals in mind, CAA alternatives were developed by combining the components of ECC and NSL alternatives presented in their respective FS reports. The major components and objectives of the alternatives are described below.

ALTERNATIVE 1--NO ACTION

The no action alternative provides a baseline for comparison of other alternatives. Since remedial actions would not be taken at the site, the public health and environmental risks would be identical to those described in the endangerment assessment.

ALTERNATIVE 2--ACCESS RESTRICTIONS WITH SOIL COVER AND LEACHATE COLLECTION AND TREATMENT

Alternative 2 includes deed restrictions, fencing, a soil cover over the landfill to promote revegetation, a soil cover over the ECC site, disposal of sediment on NSL, rerouting the surface waters, collection and treatment of the leachate seeps (estimated flowrate of 40 gpm), and monitoring of the leachate, groundwater, and surface water. The intent was to

Table 1 (Page 1 of 2)
SUMMARY OF EXPOSURE PATHWAYS AND ASSOCIATED RISKS

Operable Unit	Exposure Pathways	Associated Risks
Soil and Landfill Contents		
Surface Soil	Direct contact, inhalation, and ingestion of surface contaminants. Transport of contaminants offsite as dust and runoff.	Based on a limited number of samples of NSL, the landfill surface does not appear to be contaminated. Soil cover material at ECC was not found to be contaminated before placement onsite. Contaminated ponded water on the cover indicates cover may contain contaminants. Potential exists for adverse health effects though data do not exist to quantify risk.
Landfill Contents and Subsurface Soil	Future development onsite or erosion of the landfill surface could result in direct contact, inhalation, and ingestion of contaminants.	If development or erosion occur, potential for adverse health effects from exposure exists. Excess lifetime cancer risks for ingestion at ECC range from 4×10^{-3} to 8×10^{-6}. The exposure to the NSL landfill contents could not be quantify. However, development is the proximity of the landfill is highly unlikely.
Leachate Sediment and Sediment in Old Creek Beds of Finley Creek	Direct contact, inhalation, and ingestion of contaminants. Transport of contaminants as dust and runoff.	Potential exists for adverse health effects resulting from long term exposure to contaminants. This is based on one leachate sediment sample which contained lead and chlordane and one creek bed sediment sample which contained PCB's.
Leachate		
Leachate Seeps	Direct contact, inhalation, and ingestion of contaminants. Discharge of contaminants to surface waters.	Current risk to public health and environment is negligible since long term ingestion and use of the leachate liquid is highly unlikely. However, leachate seeps represent the potential for future release of contaminants that could result in adverse health effects for humans and adverse effects on the aquatic ecosystem in the surface waters.
Leachate Liquid in Collection System	Direct contact, inhalation, and ingestion of contaminants.	Current unacceptable risk to public health and environment is minimal since long term exposure is highly unlikely. Potential exists for contamination to increase from future releases.
Landfill Liquid	Future development onsite could result in direct contact, inhalation, and ingestion of contaminants.	Potential exists for adverse health effects; however, development in the proximity of the landfill is highly unlikely.
Groundwater	Installation of a potable well within the zones of contamination could result in direct contact, inhalation, and ingestion of contaminants.	Potential for adverse health effects from long-term exposure. Several Maximum Contaminant Limits (MCL's) are exceeded. Excess lifetime cancer risk can be as high as $4x10^{-1}$.

Table 1 (Page 2 of 2)

Operable Unit	Exposure Pathways	Associated Risks
Groundwater (Cont.)	Discharge of contaminants to surface waters.	Potential for adverse health effects from ingestion of fish bioconcentrating contaminants at projected surface water concentrations from ECC. Excess lifetime cancer risk of $1x10^{-6}$ to $3x10^{-6}$. Projected concentrations exceed WQC for protection of human health from ingestion of aquatic organisms. Concentrations of contaminants in groundwater do not currently suggest a threat to aquatic life as measured by ambient water quality criteria and LC_{50} values. However, potential for increasing contaminant types or levels in groundwater and surface water could result in adverse effects on public health and aquatic life.
	Possible migration of contaminants offsite.	Groundwater is believed to discharge to Finley Creek. In this case, risk from offsite migration is negligible. If additional investigations indicate that groundwater is flowing under Finley Creek and to the south, the risk would be reevaluated.
	Possible migration of contaminants to a deep aquifer.	Groundwater gradients are upward and this pathway is not possible.
Surface Water and Sediment	Contact or assimilation of contaminants by aquatic life.	Concentrations of contaminants in the surface waters and sediment do not currently suggest a threat to aquatic life as measured by ambient water quality criteria and LC_{50} values. However, potential for increasing contaminant types or levels in groundwater and surface water could result in adverse effects on public health and aquatic life.
	Direct contact, inhalation, and ingestion of contaminants.	Concentrations of contaminants in the surface waters and sediment do not currently suggest a threat to human health. Ingestion and use of water in Finley Creek and the unnamed ditch are highly unlikely. Increases in contaminant types or levels in future could result in adverse health effects.
	Transport of contaminants downstream to Eagle Creek and Eagle Creek Reservoir, a water supply source.	Concentrations of contaminants in the surface waters and sediment do not currently suggest a threat to human health. Future release of contaminants to the surface waters may change the concentrations and risk to public health could occur. Degradation products such as vinyl chloride may increase in the future and could become a threat to public health.

present a low-cost alternative that offers the lowest level of protection to public health and the environment. If contaminant concentrations in the proposed monitoring wells exceed applicable and relevant and appropriate requirements (ARAR's), future remedial actions would be initiated.

ALTERNATIVE 3--ACCESS RESTRICTIONS WITH RCRA CAP AND LEACHATE COLLECTION AND TREATMENT

Alternative 3 is identical to Alternative 2 with the exception of a RCRA cap over both sites in place of a soil cover. This alternative is intended to provide a greater level of public health protection by reducing contaminant migration to the groundwater through reduction in surface water infiltration while also meeting technical requirements of landfill capping for site closure under RCRA. Monitoring would still be necessary to detect migration of contaminants in the groundwater. The quantity of leachate migrating to the groundwater will be reduced significantly; however, the potential for future contamination of the groundwater remains. As with Alternative 2, if contaminant concentrations in the proposed monitoring wells exceed ARAR's, future remedial actions would be initiated.

ALTERNATIVE 4--ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT

Alternative 4 is essentially identical to Alternative 2 with the addition of groundwater interception to prevent the migration of groundwater contaminants offsite or to the surface waters. This alternative addresses the groundwater and surface water operable unit goals of providing adequate protection of public health and the environment from future contamination of the surface water. Leachate from NSL would continue to migrate to the groundwater so collection and treatment would be required indefinitely at NSL. At ECC, soil contaminants which leach to groundwater would be removed and treated, though treatment of the combined flow of 140 gpm would also likely be required indefinitely (possibly for 100 years or more).

ALTERNATIVE 5--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT

Alternative 5 includes leachate and groundwater interception and treatment similar to Alternative 4 but with a RCRA cap over the sites. The objective of the cap is to minimize further leaching of contaminants in the soil or landfill contents to the groundwater. This may eventually allow termination of the groundwater collection and treatment system though leachate collection and treatment would continue to be necessary. Treatment of an estimated 100 gpm would be necessary initially and would decline to 65 gpm after about 5 years.

ALTERNATIVE 6--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION, AND TREATMENT

Alternative 6 employs a groundwater collection system intended to lower the water table beneath the contaminated or potentially contaminated zones at both sites, thus isolating the contaminants from the groundwater. Combined with a RCRA cap the alternative is intended to eventually prevent further contamination of the groundwater and result in groundwater treatment of leachate only. The initial flow requiring treatment is estimated at 340 gpm, declining to 210 gpm after 5 years and finally to 6 gpm within 15 years. The collection system, however, would be operated indefinitely to maintain the lower water table. This alternative is intended to provide a greater level of protection to the public health and environment by reducing contaminant migration.

ALTERNATIVE 7--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION, AND TREATMENT, AND ECC SOIL VAPOR EXTRACTION

Alternative 7 incorporates all the components and objectives of Alternative 6 with the additional treatment of ECC-contaminated soil. Soil vapor extraction would be used to reduce VOC's in the unsaturated zone to below 10^{-6} cancer risk levels. The public health risk from direct contact with ECC-contaminated soil in the event of site development would be greatly reduced. It is not expected that this would reduce the groundwater treatment period.

ALTERNATIVE 8--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL INCINERATION

Alternative 8 incorporates the objectives of Alternative 7. However, ECC soil contaminated with organics is treated via onsite incineration. All soil with organic contaminant levels above 10^{-6} cancer risk levels or acceptable daily intake levels would be incinerated. This results in permanent destruction of organic contaminants.

ALTERNATIVE 9--ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

Alternative 9 includes deed restrictions; excavation of the landfill contents, peripheral soils, sediments, and ECC-contaminated soil; and disposal of the waste materials in an onsite RCRA-type landfill. This alternative addresses all the operable unit goals and provides the highest level of protection of all the alternatives.

DETAILED ANALYSIS OF ALTERNATIVES

Each alternative is evaluated using technical, public health and welfare, environmental, institutional, and cost criteria. The detailed cost analysis for each alternative includes estimates of operation and maintenance (O&M) costs, capital costs, replacement costs, and development of present worth.

The results of the detailed analysis are summarized in Table 2.

COMPARISON OF ALTERNATIVES

ALTERNATIVE 1--NO ACTION

The No Action Alternative does not mitigate or minimize the existing threats to public health and environment identified in the endangerment assessments for the sites and summarized in Chapter 1 of this report. Potential adverse effects exist for exposure to contaminants in soils, landfill contents, sediment, leachate, groundwater, and surface waters. Since remedial actions are required to mitigate or minimize these existing or potential exposures, the No Action Alternative is not recommended by U.S. EPA.

ALTERNATIVE 2--ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION AND TREATMENT

The total present worth of Alternative 2 is $18,100,000. It is considered by EPA to be effective in mitigating and minimizing threats to public health and the environment from exposure to contaminated soils, landfill contents, sediment and leachate.

The remedial actions do not address leaching of contaminants to the groundwater or migration of contaminated groundwater to surface water. This alternative relies on monitoring to detect increases in contaminant levels or types in groundwater and surface water. Because groundwater monitoring locations of necessity are located very near surface water discharge areas, there may not be sufficient time for implementation of remedial actions before adverse effects occur if previously undetected contaminants or increased levels of contaminants are detected. Since the potential for increasing contaminant levels or types is great because of the heavily contaminated ECC soils and the reported large quantities of hazardous waste disposed of at NSL, monitoring alone is not considered a reliable means of protecting the public health and environment. Therefore, Alternative 2 is not recommended by EPA.

EVALUATION CRITERIA	ALTERNATIVE 6 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment	ALTERNATIVE 7 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Vapor Extraction	ALTERNATIVE 8 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration	ALTERNATIVE 9 Access Restrictions With Onsite RCRA Landfill
Technical	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates leachate discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained. Releases from leaking drums or pools of immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Groundwater isolation system provides additional time for further remediation if failure detected. Estimated time of design and construction is 1 to 2 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Public health risk from future site excavation and direct contact, inhalation, and ingestion of VOC's in ECC contaminated soil is reduced to below 10^{-6} cancer risk levels. Potential ADI exceedance for lead and cadmium is unchanged but mitigated by access restrictions and cap. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. ECC soil vapor extraction greatly reduces generation of contaminated leachate. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained. Releases from leaking drums or pools of immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Groundwater isolation system provides additional time for further remediation if failure detected. Installation of cap over ECC would follow the 2 to 4 year operation period of soil vapor extraction. Total estimated time of design and construction is 3 to 6 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Public health risk from future site excavation and direct contact, inhalation, and ingestion of organic contaminants in soil reduced to below 10^{-6} cancer risk levels. Potential ADI exceedance for lead and cadmium is unchanged but mitigated by access restrictions and cap. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. ECC soil incineration greatly reduces generation of contaminated leachate. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained. Releases from leaking drums or pools of immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Groundwater isolation system provides additional time for further remediation if failure detected. Installation of cap over ECC would follow the 3 to 4 years implementation period of ECC soil incineration. Total estimated time of design and construction is 4 to 6 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with contaminants by eliminating surface leachate discharge. If properly constructed, the onsite RCRA landfill would prevent leachate discharges. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Effective in preventing migration of contaminated groundwater to surface water or offsite. Long-term reliability of RCRA landfills has not been demonstrated though is believed to be good given proper maintenance. Monitoring is essential to check the integrity of the landfill liner. Estimated time of design and construction is 3 to 5 years. Potential for exposure of construction workers during excavation is very high.
Public Health and Environment	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation Noise and dust generated by truck traffic during RCRA cap construction. Aquatic habitat improves over time because of cessation of contaminant discharge to Finely Creek.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Aquatic habitat improves over time because of cessation of contamination discharge to Finley Creek. Noise and dust generated by truck traffic during RCRA cap construction.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Aquatic habitat improves over time because of cessation of contaminant discharge to Finley Creek. Noise and dust generated by truck traffic during RCRA cap construction. Release of contaminants to the air or surface water during ECC soil excavation could occur.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Aquatic habitat improves over time because of cessation of contaminant discharge to Finely Creek. Releases of contaminants to the air or surface water during landfill excavation could occur. Short-term generation of noise and dust from truck traffic and heavy equipment operation onsite during RCRA landfill construction.
Institutional	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.	All standards will be met. CERCLA goals will be met. Requires delisting of residue to dispose of it onsite. No permits required but need to follow technical requirements.	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.

COST

	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Capital	$27,600,000	$28,500,000	$66,400,000	$105,000,000
Annual Average Operation and Maintenance	849,000	896,000	849,000	275,000
Total Present Worth	37,300,000	39,300,000	76,100,000	108,000,000

TABLE 2 (Page 2 of 2)
SUMMARY OF DETAILED EVALUATION OF ALTERNATIVES
ECC-NSL CAA

EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Access Restrictions With Soil Cover, Leachate Collection and Treatment	ALTERNATIVE 3 Access Restrictions With RCRA Cap, Leachate Collection and Treatment	ALTERNATIVE 4 Access Restrictions With Soil Cover, Leachate Collection, Groundwater Interception and Treatment	ALTERNATIVE 5 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Interception and Treatment
Technical	Potential exists for adverse health effects resulting from exposure to subsurface soil, landfill contents, and leachate sediments and sediments in the old creek beds of Finley Creek. Soil cover at ECC may pose low level public health risk. Potential exists for adverse effects to public health and environment from future releases of contaminants in leachate. Potential exists for adverse health effects from consumption of contaminated groundwater or fish that have bioconcentrated contaminants. Potential exists for adverse effects on public health and environment from future releases of contaminants to surface water.	Effective in protecting public health from direct contact with soil contaminants given proper implementation of deed restrictions and maintenance of soil cover for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with leachate contaminants by eliminating surface leachate discharge. Leachate collection and soil cover eliminates leachate discharges to surface water. Leachate can still migrate to groundwater. Migration of contaminated groundwater to surface water is not eliminated. Groundwater and surface water monitoring should allow detection of contaminants posing risks. However, sufficient time to implement remedial action may not be available before public health or environment are affected. Monitoring frequency and comprehensiveness are critical to successful implementation. Estimated time of design and construction is 6 months to 1 year.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with leachate contaminants by eliminating surface leachate discharge. Leachate collection and RCRA cap eliminates leachate discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Migration of contaminated groundwater to surface water is not eliminated, although would be reduced relative to Alternative 2. Groundwater and surface water monitoring should allow detection of contaminants posing risks. However, sufficient time to implement mitigative action may not be available before health or environment are affected. Monitoring frequency and comprehensiveness are critical to successful implementation. Estimated time of design and construction is 1 to 2 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of soil cover for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with leachate contaminants by eliminating surface leachate discharge. Leachate and groundwater collection and soil cover eliminates discharges to surface water. Leachate can still migrate to groundwater which is subsequently collected and treated. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater interception and treatment system. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional storage volume should be considered. Estimated time of design and construction is 1 year.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates leachate discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater interception and treatment system. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Estimated time of design and construction is 1 year.
Public Health and Environment		Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Minor dust releases and noise generation during site work.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation Noise and dust generated by truck traffic during RCRA cap construction.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation Minor dust releases and noise generation during site work. Aquatic habitat improves over time because of cessation of contaminant discharge to Finley Creek.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Noise and dust generated by truck traffic during RCRA cap construction. Aquatic habitat improves over time because of cessation of contaminant discharge to Finley Creek.
Institutional	Uncontrolled hazardous waste site does not meet goals of CERCLA. Groundwater in violation of drinking water quality criteria. Surface water exceeds ambient water quality criteria for protection of human health.	Water quality criteria may be violated. May need to acquire land and implement deed restrictions. The potential for releases of contaminated groundwater from the site continues, so policy of CERCLA may not be met.	Water quality criteria may be violated. May need to acquire land and implement deed restrictions. The potential for releases of contaminated groundwater from the site continues, so policy of CERCLA may not be met.	The CERCLA goal of protection of public health, welfare, and environment is achieved.	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.
COST					
Capital	-0-	$ 8,710,000	$21,400,000	$11,200,000	$24,900,000
Annual Average Operation and Maintenance	-0-	941,000	819,000	982,000	832,000
Total Present Worth	-0-	18,100,000	29,900,000	20,800,000	33,900,000

TABLE 2 (Page 1 of 2)
SUMMARY OF DETAILED EVALUATION OF ALTERNATIVES
ECC-NSL CAA

ALTERNATIVE 3--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

The present worth of Alternative 3 is $29,900,000. The cap would reduce leaching of contaminants to the groundwater by an estimated 90 percent and as a result it would reduce the potential for contaminant levels to increase in the future. Migration of groundwater contaminants to surface water, however, would not be mitigated and, as with Alternative 2, protection of public health and environment would be dependent on groundwater and surface water monitoring. As discussed earlier, monitoring alone is not considered reliable. Alternative 3 is not considered to provide adequate protection of public health and the environment and is not recommended by EPA.

ALTERNATIVE 4--ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION AND TREATMENT

The present worth cost of Alternative 4 is $20,800,000. This alternative is considered effective in protecting public health and the environment from site contamination. The groundwater and leachate collection and treatment systems, however, would be required to operate for a long period of time, possibly in excess of 100 years, because contaminants could continue to leach from soils and landfill contents. Though groundwater collection and treatment has been shown to be reliable, continued maintenance and operation far into the future cannot be assured.

ALTERNATIVE 5--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION AND TREATMENT

The present worth of Alternative 5 is $33,900,000. The cap would reduce leaching of contaminants from the unsaturated zone to the groundwater by an estimated 90 percent and, as a result, could reduce the potential for contaminant levels to increase in the future. It is possible that the cap may also reduce the operational period for the groundwater collection and treatment system, though the actual period of operation cannot be reliably estimated.

ALTERNATIVE 6--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT

The total present worth of Alternative 6 is $37,300,000. The groundwater isolation system employed in Alternative 6 lowers the groundwater table below the zone believed to be currently contaminated. The intent is to isolate contaminants in the unsaturated zone so they cannot migrate in groundwater. Eventually the groundwater would no longer be contaminated and treatment would not be necessary. This may occur when the water table is fully lowered, estimated to be 5 years. It is possible, however, that contaminants released from buried drums or immiscible fluids could migrate to the lower water table. As a result, the reliability of the groundwater isolation system to reduce the operational period of groundwater treatment is not assured. In addition, the groundwater collection system would have to be operated indefinitely to maintain the lower water table. As with Alternatives 4 and 5, the reliability of long-term maintenance and operation of the collection system is unknown.

The isolation system of Alternative 6 does provide substantially more time between a potential collection system failure and a release of contaminants to surface water. This occurs because of time necessary for the water table to rise onsite and groundwater gradients reverse. Since the time available under Alternatives 4 and 5 is considered substantial, this is not considered a significant benefit.

ALTERNATIVE 7--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL VAPOR EXTRACTION

The present worth of Alternative 7 is $39,300,000. The major public health and environmental benefit of soil vapor extraction is the removal of the relatively mobile volatile organic compounds (VOC's) from the soil. This results in a reduced potential for human exposure or overland migration of VOC contaminants offsite in the event of site development. The probability of site development, in violation of deed restrictions, at some point in the future is not known but is believed to be minimal because of the presence of the immediately adjacent NSL site. If site development were to occur, health threats from exposure to other organic and inorganic contaminants would still be present. Removal of VOC's from the unsaturated zone would have little effect on the operational period of the groundwater collection system since these contaminants would be nearly immobilized by the construction of a RCRA cap over the ECC site.

Because a public health threat would remain in the event of future ECC site development and because removal of VOC's from the unsaturated zone is not expected to affect groundwater collection and treatment, the advantages of soil vapor extraction are not considered great. The expenditure of $2,000,000 in present worth for ECC soil vapor extraction for the marginal reduction in health threat is not considered cost effective. Alternative 7 is not recommended by EPA.

ALTERNATIVE 8--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL INCINERATION

The present worth of Alternative 8 is $76,100,000. ECC soil incineration would result in the destruction of all organic contaminants in soil in the unsaturated zone with contaminants above the 10^{-6} cancer risk level. The resulting reduction in health threats in the event of future site development would be greater than in Alternative 7. The presence of NSL adjacent to ECC and the restrictions on the deed preventing site development make this unlikely. The present worth of $38,800,000 for ECC soil incineration for reducing public health threats in the unlikely event of future site development is not considered cost effective. Alternative 8 is not recommended by EPA.

ALTERNATIVE 9--ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

The present worth of Alternative 9 is $108,000,000. The new landfill would include a double liner, leachate collection system, leachate and groundwater monitoring system, gas collection system, and multimedia cap.

The new landfill would effectively isolate the contaminants from the environment. Operation and maintenance of the facility would be required indefinitely. Though long-term reliability of the facility is believed to be good, proper operation and maintenance far into the future cannot be assured. Exposure of workers to the hazardous materials may occur during excavation of ECC soils and the landfill. Also inadvertent releases to the environment by volatilization or surface erosion during the several years of construction activity would likely occur. The expenditure of $108,000,000 in present worth is not considered cost effective by EPA when the hazards induced by site excavation are considered and the availability of a lower cost alternative with a similar level of protection for the public health and environment.

COMPARISON OF ALTERNATIVES 4, 5 AND 6

Alternatives 4, 5 and 6 were all found to provide adequate protection of public health, welfare, and environment, if they are operated and maintained through the period of continued contaminant release. Since this period may be in excess of 100 years, an important consideration in alternative selection is to minimize the operation and maintenance necessary, particularly in regards to collection and treatment of contaminated leachate and groundwater. Generally, the less operation and maintenance required the more reliable the system will be in the future.

Alternative 4 requires the greatest amount of treatment for leachate and groundwater since it does not include a RCRA cap. An estimated 40 gpm of leachate and 100 gpm of groundwater may require treatment in excess of 100 years. In comparison to Alternatives 5 and 6, which include a RCRA cap, Alternative 4 would have the poorest long-term reliability for continued effective operation.

Alternatives 5 and 6 both reduce leachate generation to an estimated 5 gpm as a result of the RCRA cap. The groundwater isolation system of Alternative 6 could reduce the need for treatment to leachate only. This could occur as early as 5 years. For the reasons noted earlier, however, this is uncertain and treatment of groundwater may be required indefinitely, as is the case for Alternative 5. In addition, Alternative 6 would require operation and maintenance of the collection system indefinitely, irrespective of whether treatment is necessary.

Comparison of the costs of Alternatives 5 and 6 show Alternative 6 with the following higher costs:

- $2.7 million more in capital cost because of the groundwater isolation system
- $17,000 more in annual operation and maintenance costs (assuming 15 years of groundwater treatment for Alternative 6) as a result of high initial flow rates
- $3.4 million more in present worth

The present worth of Alternative 6 would still be $1.6 million more than Alternative 5 if treatment of groundwater could be terminated after 1 year. Groundwater treatment beyond 15 years would result in even greater cost differences between Alternatives 5 and 6. Because of the greater costs of Alternative 6 and the uncertainty regarding the period of groundwater treatment, it is not recommended by EPA.

RECOMMENDED ALTERNATIVE

U.S. EPA's recommended alternative is Alternative 5. The major components of the alternative are:

- Access restrictions
- Cooling pond sludge removal
- RCRA cap and surface controls
- Monitoring
- Leachate collection
- Groundwater interception
- Treatment

A site plan of Alternative 5 is shown in Figure 1.

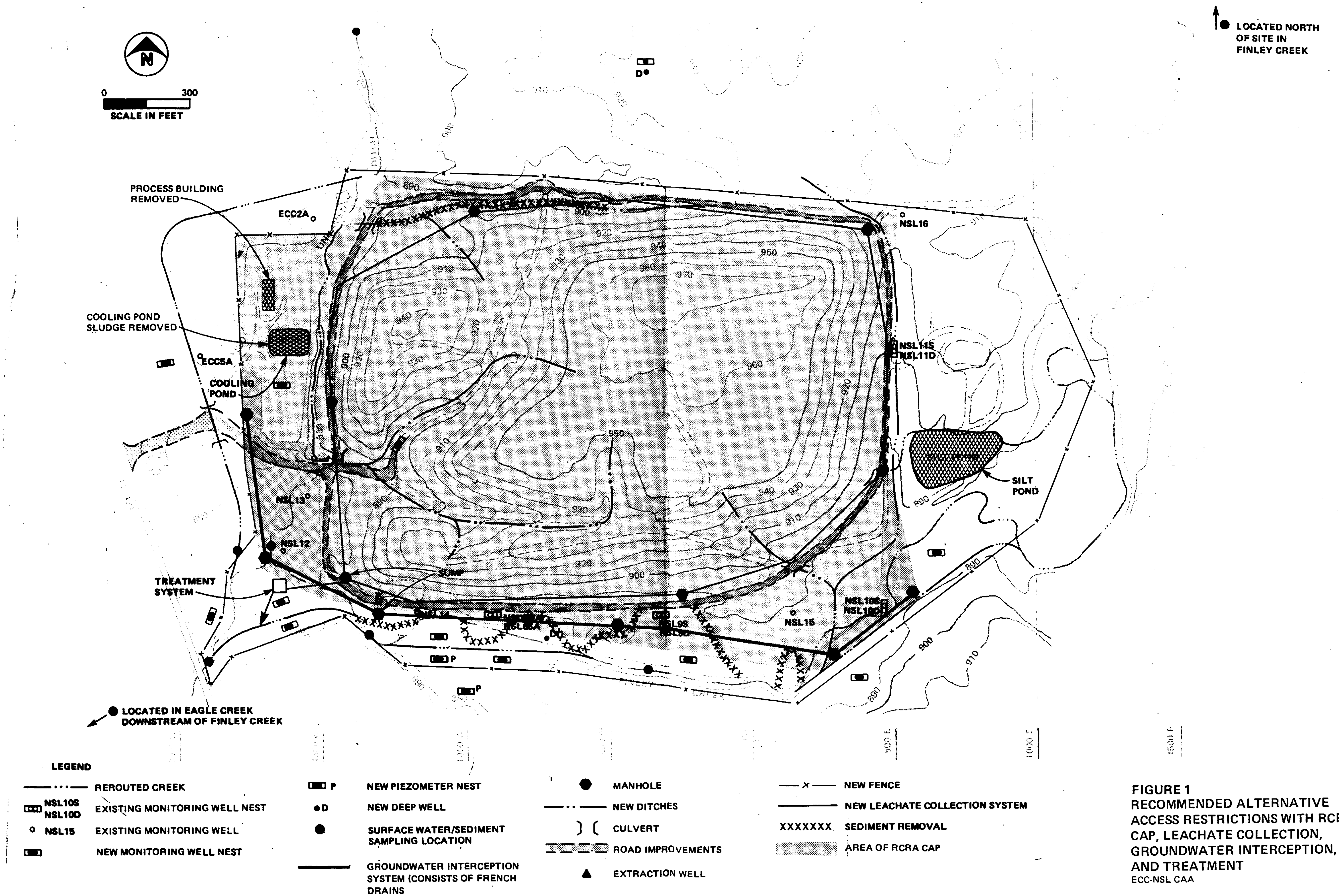


FIGURE 1
RECOMMENDED ALTERNATIVE
ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT
ECC-NSL CAA

ACCESS RESTRICTIONS

Deed restrictions would be placed on the landfill property and the ECC site. The restrictions should prevent future development of the land to protect against direct contact with contaminants or further migration that could result from site excavation and development. The deed restrictions should also prohibit use of groundwater or installation of wells onsite. Access to the site would be controlled by completing the fencing around the site perimeter and posting signs.

COOLING POND SLUDGE REMOVAL

Contaminated sludge or soil remaining in the former ECC cooling pond would be excavated and disposed of at a licensed RCRA landfill. Soil samples would be collected from soil borings in the former cooling pond and analyzed to determine excavation locations and volumes. Excavated sludge or soil would be replaced with clean fill. Removal of the remaining contaminated sludge would reduce contamination of the sand and gravel deposit beneath ECC. Groundwater removed during sludge excavation would be transported and treated at a licensed RCRA facility or treated onsite in the groundwater treatment system.

RCRA CAP AND SURFACE CONTROLS

These actions include removal of contaminated sediment, rerouting of creeks, and construction of a multimedia cap over ECC and NSL.

Contaminated leachate sediment and sediment in the ditch north of NSL and the old creek beds of Finley Creek would be excavated, dewatered, and disposed of onsite beneath the cap. It was assumed for cost estimating that excavation to a 1-foot depth would be necessary and a total of 4,200 cubic yards would be removed. The actual volume removed would be dependent on further sampling undertaken as part of final design. The creek beds would be backfilled and a soil cover would be placed over areas not under the cap. Contaminated water resulting from the dewatering of the sediment would be treated in the onsite treatment system.

The unnamed ditch would be rerouted to the west of ECC and portions of Finley Creek would be rechannelized. This would route the surface waters farther away from contaminated areas and increase the time available between contaminant detection in groundwater and discharge to Finley Creek or the unnamed ditch.

The RCRA cap would cover both ECC and NSL and include two low permeability layers. From top to bottom, the cap includes 1 foot of soil for vegetative growth, 1.5 feet of a sand and gravel for drainage, a 30-mil synthetic membrane, 2 feet of clay, and 1 foot of sand (for gas collection on the landfill only). Prior to placing the cap, the site would be graded to eliminate sharp grade changes and to provide for drainage. Also the former process building on the ECC site would be demolished. The concrete floor and foundation would remain and the cap placed on top. The cap would be seeded to control erosion and promote evapotranspiration.

The RCRA cap is expected to reduce the rate of leachate production from 40 gpm to 5 gpm within 5 years. The resulting leachate flowrate requiring treatment would also decrease from 40 gpm to 5 gpm.

MONITORING

Contaminant migration would be assessed through a regular leachate, groundwater, and surface water monitoring program. Leachate would be sampled at the leachate collection sump as part of the leachate collection and treatment system. Groundwater would be monitored during the first year using 15 of the existing wells and an additional 26 new monitoring wells. The 41 monitoring wells would be sampled quarterly the first year and analyzed for the full organic and inorganic priority pollutant list.

Monitoring well sampling would be reduced dependent on results of the four initial sample rounds. It is estimated that subsequent semiannual sampling would be necessary at 14 wells. Samples would be analyzed for VOC's, semivolatiles, and inorganics. Water levels of monitoring wells would be taken at the time of sampling and gradients would be calculated.

Surface water and sediment would be sampled at eight locations semiannually. These samples would be analyzed for VOC's, base/neutrals, pesticides, PCB's, and inorganics. Depending on surface water results, fish may be occasionally collected from Finley and Eagle Creek and their tissues analyzed for bioaccumulation of organic contaminants.

LEACHATE COLLECTION

The leachate collection system would consist of a French drain encircling the landfill. The drain would be about 4 feet deep and about 6,000 feet in length. Perforated pipe laid in the trench would be used to transport leachate to a sump located near the treatment system in the southwest corner of the site. The trench would be backfilled with gravel. A 1-foot layer of gravel would also be placed on the sideslopes of the landfill to provide a drainage path for leachate seepage. The RCRA cap described previously would extend over the gravel layer and the drainage trench. The existing leachate collection system would be decommissioned and abandoned.

GROUNDWATER INTERCEPTION

The objective of the groundwater collection system is to prevent contaminated groundwater from migrating past the perimeter of ECC and the landfill and discharging to surface waters. The collection system costed and described here for this alternative will meet this objective based on the information available to date. Further site investigations during final design may alter the design of the collection system; however, the objective of the groundwater interception system will be met.

The groundwater collection system costed consists of a French drain installed along the southern and southwestern boundaries of the landfill and ECC. The trench would be about an average depth of 25 feet (see Figures 4-1, 4-2, and 4-3). The trench would include two collection pipes, one set 5 feet below the existing water table to function as the interception system, and the other set at the bottom of the trench to be used if the isolation system is implemented at a later time. It is anticipated that an approximate 5-foot overall drawdown of the water table at the collection system would be sufficient to prevent groundwater movement past the system. The French drain would include an impermeable barrier on the south wall of the trench to minimize inflow of water from Finley Creek. The barrier consists of an impermeable synthetic membrane and at least 6 inches of compacted clay. It would extend 3 feet into the till below the sand and gravel deposit in the southwest area of the site. The barrier would also extend 75 feet beyond the western end of the drain.

The initial combined flowrate from the leachate and groundwater collection systems is estimated to be 100 gpm with 40 gpm from the leachate collection system. Within 5 years, the flow is estimated to decrease to about 65 gpm because of a reduction in leachate generation.

TREATMENT

Treatment of leachate and groundwater will be required to meet effluent discharge limits set in the NPDES permit for discharges to Finley Creek. The limits must protect aquatic life and human health from consumption of aquatic organisms and human health from use of the downstream Eagle Creek Reservoir as a drinking water supply.

The onsite treatment system costed and described here will be capable of meeting the effluent limits. During final design, the treatment system will likely be modified based on pilot and bench-scale testing and more detailed evaluations of capital and operation and maintenance costs. The objective of meeting the discharge limits will be obtained, however.

Leachate and groundwater would be pumped to an onsite treatment plant consisting of precipitation, biological oxidation, and carbon adsorption. The two streams would be combined in a 100,000-gallon holding tank. In the treatment system, the waste stream first passes through the precipitation process for removal of metals and other inorganics. Chromium, copper, iron, lead, and zinc were detected in the groundwater and leachate samples and can be removed by precipitation. Hydroxide precipitation is used for cost estimating purposes. Flocculation and clarification follow the chemical addition and can be accomplished in one basin. Either flocculation with lamella gravity settlers or solids contact clarifiers could be used. Sludge is removed from the bottom of the basin and can be thickened, dewatered with a filter press, and disposed of in a RCRA landfill.

Effluent from the precipitation process then goes through powdered activated carbon treatment (PACT), which is a patented activated carbon enhanced biological treatment system. The PACT system combines biological treatment and carbon adsorption into one process. The system works through the addition of powdered activated carbon to the influent of the activated sludge process. The system consists of carbon feeding equipment, an aeration basin with the necessary appurtenances, a clarifier, and solids handling equipment. Solids would be wasted to an aerobic digester followed by dewatering. Solids would then be disposed of at a RCRA landfill unless they could be delisted as a nonhazardous waste. Spent carbon in the waste solids could be separated and regenerated offsite.

Granular media filtration would be included in the treatment system following either the precipitation system or the PACT system or both The advantage of having a filter after each unit would be that less metals would carry over into the PACT system and that solids with low settleability would be removed from the biological system effluent. For costing purposes, however, it is assumed that one filter will be used after the PACT system.

OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance would be required for the cap because of erosion, freeze/thaw, and landfill settlement. It was estimated that every fifth year, 10 inches of fill over 50 percent of the landfill would need replacement. Regular mowing of grass on the cap is required. Routine inspections of the cap surface and the leachate and groundwater collection systems would be required semiannually. Replacement of collection system pumps, cleaning of collection system drains, and refurbishment of monitoring well screens would be undertaken as necessary.

The treatment system would require full-time operators to perform testing and maintenance, to adjust chemical and carbon feed rates, and to ensure that all process units are functioning properly. To provide for regular maintenance or in the event of treatment system failure, a 100,000-gallon holding tank is included. This tank provides a 2-day holding time for untreated leachate.

GLT655/2

Chapter 1
INTRODUCTION

The U.S. Environmental Protection Agency (EPA) and the Indiana Department of Environmental Management (IDEM), formerly the Indiana State Board of Health (ISBH), have determined that the Environmental Conservation and Chemical Corporation (ECC) site and the Northside Sanitary Landfill (NSL) site both near Zionsville, Indiana, pose a threat to the public health, welfare, and the environment. Under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and Execution Order 12316, EPA is given the authority to control the actual or potential release of hazardous substances that pose a substantial threat to the public health, welfare, and the environment.

This Combined Alternative Analysis (CAA) report discusses the study methods used in developing and evaluating remedial action alternatives for the adjacent sites. The alternatives developed in this report are derived from the alternatives developed for the individual sites and discussed in the ECC and NSL FS reports. The purpose of combined alternatives for the adjacent sites is to ensure the remedial actions are compatible with each other, to avoid duplicate remedial actions, and to integrate remedial actions to achieve cost savings. CERCLA Section 104(d)(4) states that sites geographically close or posing similar threats to the public health, welfare, and the environment may be treated as one site.

This report briefly summarizes the Remedial Investigation (RI) results for each of the sites along with the endangerment assessment results (Chapter 1). Chapter 2 presents the remedial action objectives for the combined sites and the assembly of the combined remedial actions. The detailed analysis of alternatives is presented in Chapter 3 followed by the recommended alternative in Chapter 4.

The CAA report is based on information contained in the following reports:

- Final ECC RI Report, March 14, 1986
- Final NSL RI Report, March 27, 1986
- Public Comment ECC FS Report, November 7, 1986
- Public Comment NSL FS Report, November 7, 1986

SITE BACKGROUND

The ECC and NSL sites are next to each other in a rural area of Boone County, Indiana, near the intersection of State Route 32 and U.S. Highway 421 and about 10 miles northwest of Indianapolis. The ECC site occupies 6.5 acres immediately west of the 168-acre NSL site, of which approximately 70 acres is landfilled (Figure 1-1).

NSL is a privately owned and operated active solid waste disposal facility. The site has been active since at least 1962 and has accepted various industrial and municipal wastes during the course of its operation. The vice president of NSL has estimated 16 million gallons of hazardous wastes have been disposed of in the landfill. A 3-acre oil separation lagoon on the landfill surface is evident in a 1977 aerial photograph. The site has had recurring operational deficiencies as reported by ISBH. The EPA detected leachate running into Finley Creek, and groundwater contamination was detected in monitoring wells at the site. The site was placed on the National Priorities List in 1983.

ECC began operations in 1977 and was engaged in the recovery/reclamation/brokering of primary solvents, oils, and other wastes received from industrial clients. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Reclamation processes included distillation, evaporation, and fractionation to reclaim solvents and oil.

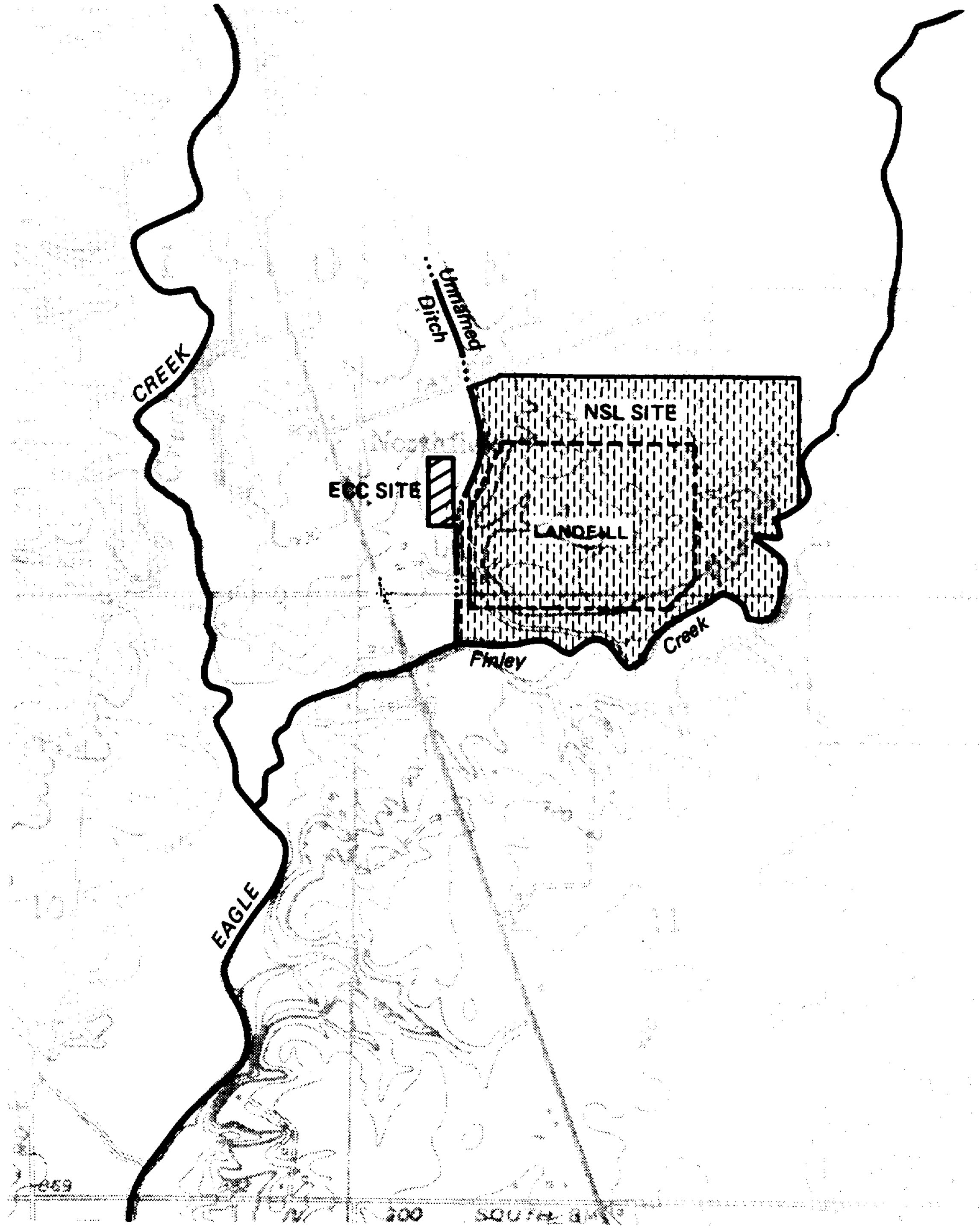
Several memorandums from ISBH discuss the disposal of ECC wastes in the NSL landfill. ECC wastes reportedly disposed of at NSL were 5,000 gallons/month of wastewater from the ECC oil reclamation process, still bottoms and solvent recovery waste, 50 to 80 drums/day of paint sludge, thinner, stain and resin sludge, and at least 7,000 drums of unreported contents.

Drum shipments to ECC were halted in February 1982 after EPA and ISBH investigations showed accumulation of contaminated stormwater onsite, inadequate management of drum inventory, and several spill incidents. EPA subsequently conducted removal actions at ECC including removal, treatment, and disposal of cooling pond waters, about 30,000 drums of waste, 220,000 gallons of hazardous waste from tanks, and 5,650 cubic yards of contaminated soil and cooling pond sludge.

SITE DESCRIPTION

The area surrounding the sites is largely undeveloped. Land use to the east and south of the site is agricultural, to the west and north it is residential. Approximately 50 residences are within 1 mile of the site.

An unnamed drainage ditch that separates NSL from the ECC site flows into Finley Creek near the southwest corner of the landfill (Figure 1-2). Finley Creek discharges into Eagle Creek about one-half mile downstream of the site. Eagle Creek then flows south for about 9 miles before emptying



LEGEND

- NSL SITE
- ECC SITE
- LANDFILL AREA
- SITE BOUNDARY

SOURCE: U.S.G.S. 7.5 min.quadrangle, Rosston, Ind. 1969.

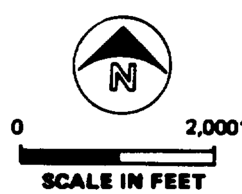


FIGURE 1-1
SITE MAP
ECC - NSL CAA

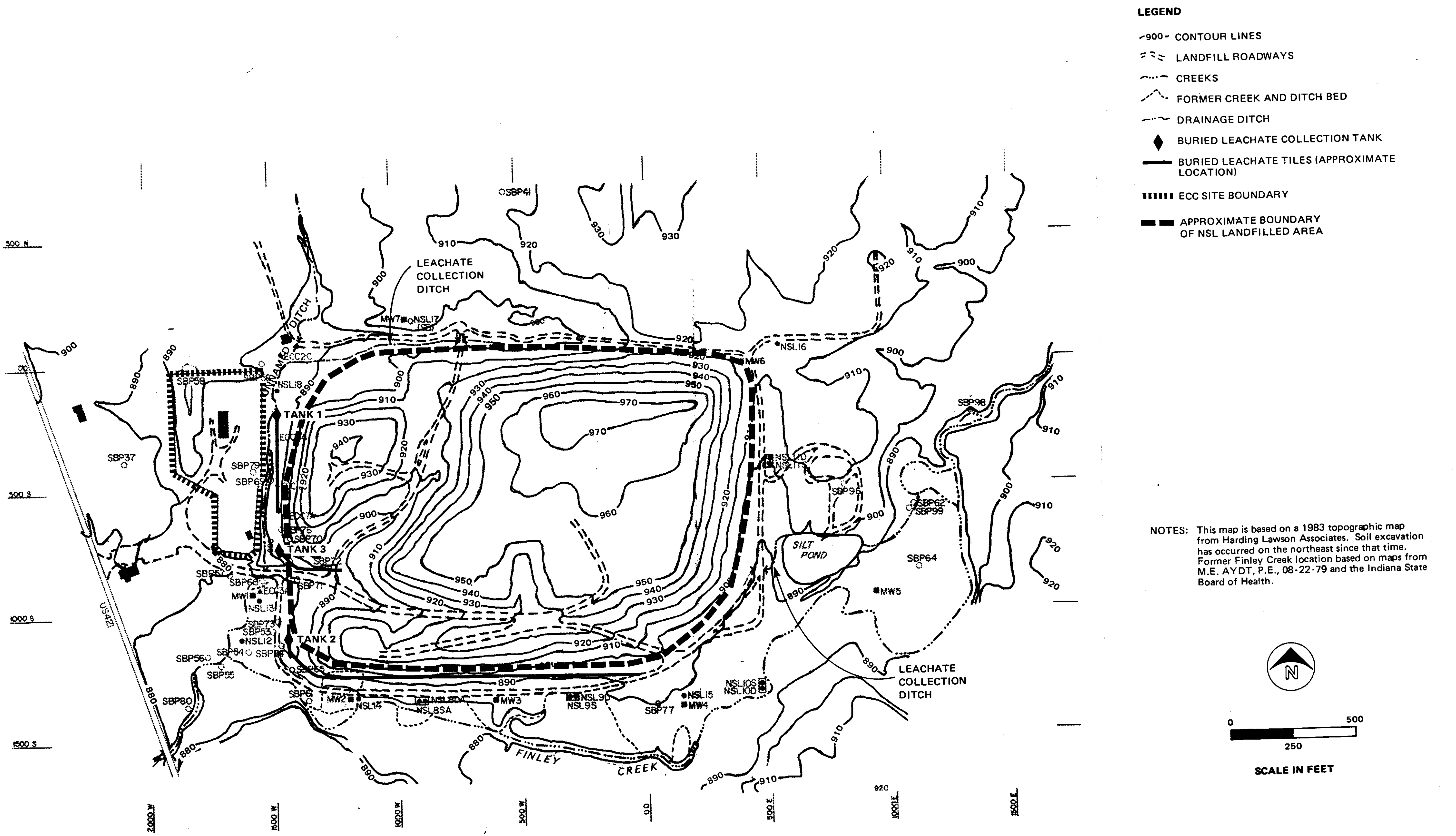


FIGURE 1-2
SITE FEATURES
ECC - NSL CAA

into the Eagle Creek Reservoir, which is used by the City of Indianapolis for a portion of its drinking water supply.

The surface of the landfill ranges from 30 feet to 70 feet above the surrounding grade. The sideslopes of the landfill are steep with shallow erosion gullies commonly present. Leachate seeps have been evident on all sides of the landfill. Two manmade ditches, one on the north side and one on the east side of the landfill, act as collection ditches for the leachate. The former ditch drains to the unnamed ditch and the latter drains directly to Finley Creek. The north ditch was observed during the remedial investigation to have a constant baseflow of leachate generated by the landfill. A leachate collection system consisting of three holding tanks and collection tiles was installed to control leachate discharges.

The landfill cover generally consists of silty clay till material that was borrowed from the area immediately north of the landfill. The cover is generally barren with some areas of sparse vegetation. It is fairly well compacted in areas that support vehicular traffic during operation. The surface is sloped to prevent ponding but shallow erosion gullies are evident in all areas of the cover. A shallow silt pond east of the landfill collects surface runoff from the eastern portion of the site and discharges to Finley Creek. The NSL site is not fenced nor is access to the site strictly controlled.

The ECC site is covered with a silty clay cap except in the southern third of the site where a concrete pad used during site operation is still in place. A sump in the southeast corner of the site collects contaminated water beneath the concrete pad. The ECC process building is in the northern half of the site. Access to the site is restricted by a surrounding fence.

REMEDIAL INVESTIGATIONS

Remedial investigations including soil, hydrogeologic, surface water, and sediment investigations of the sites began in 1983 and continued to November 1985. Details of the investigations are included in the ECC and NSL Remedial Investigation Reports.

HYDROGEOLOGIC CHARACTERISTICS

Geology

The site geology is summarized from Shaver and Sunderman (1983). The sites and all of Boone County are located on the Tipton Till Plain. The Tipton Till Plain is an extensive flat to gently rolling area formed on ground moraine glacial till deposited during the Wisconsinan glacial advance. In general, 150 to 200 feet of glacial till overlies Devonian limestone and dolomite bedrock.

The till deposits consist mainly of dense silty clays that contain scattered and discontinuous deposits of sand, gravel, and silty sand at varying elevations. These coarse grain deposits appear to be glacio-fluvial and lacustrine in origin and form discontinuous lenses within the till.

A sand and gravel lens which extends beneath the ECC site and the southwest corner of the NSL site has a thickness of approximately 4 to 24 feet and a base elevation of 850 to 865 feet. The top of this lens is near the land surface in the southwest corner of the NSL site.

A continuous layer of sand and gravel, 2 to 15 feet thick, has been identified near the base of the till deposit. This layer is typically encountered at depths of 150 to 200 feet below land surface.

Hydrogeology

Because of the thin and discontinuous nature of the sand and gravel deposits within the till unit, it is not expected that they will act as a single water-bearing unit that will influence the overall movement of groundwater beneath the site. The permeable sand and gravel zones may be characterized by localized confined groundwater conditions, and groundwater movement through the sand and gravel zones may occur at velocities that are greater than the average for the overall till unit. For this combined alternative analysis, the till unit has been considered as a single water-bearing unit.

The sand and gravel lens beneath the ECC site and the southwest corner of the NSL site is near the land surface in the vicinity of Finley Creek and therefore forms a pathway for contaminated groundwater to discharge directly to the creek. Because of this, and because the thickness and continuity of the lens is greater than other sand and gravel lenses encountered in the test borings, this lens has been considered as a discrete water-bearing unit within the glacial till.

The water-bearing units beneath the site can be summarized as follows:

- The water-bearing unit beneath the landfill (except in the southwest corner) consists of glacial till that contains discontinuous lenses of sand and gravel which do not constitute a separate water-bearing unit.

- In the southwest corner of the landfill, the sand and gravel lens is of sufficient thickness and continuity to be considered as a discrete water-bearing unit. It is overlain by a water-bearing unit of glacial till and is underlain by glacial till that is much less permeable than the sand and gravel.

- The continuous layer of sand and gravel near the base of the till deposit at depths of 150 feet to 200 feet below the land surface constitutes a deep, confined water-bearing unit.

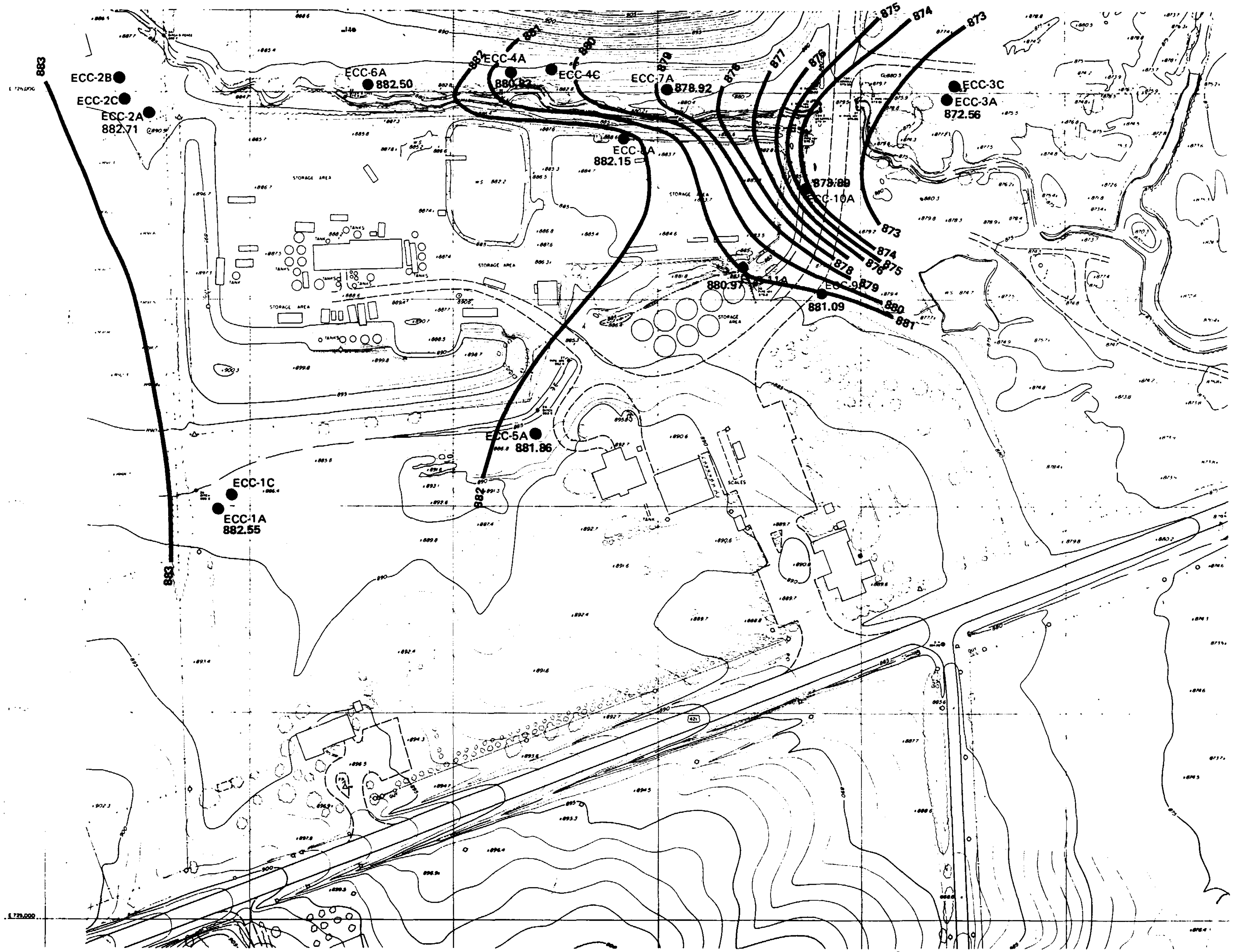
Groundwater levels in wells at the ECC site indicate that there is a vertical upward hydraulic gradient from the shallow sand and gravel lens to the overlying water-bearing till deposit. The water table beneath ECC is located in the till overlying the sand and gravel. Potentiometric surface contours for the shallow sand and gravel lens beneath the ECC site are shown in Figure 1-3. There are not enough data at ECC to allow for contouring of the water table in the till.

Groundwater in the glacial till water-bearing unit beneath NSL is unconfined. Contours of the water table in the till are shown in Figure 1-4. Groundwater in the sand and gravel lens in the southwest portion of the site is unconfined where the sand and gravel is at the ground surface.

Regional groundwater flow is from the northeast to the southwest with regional discharge at Eagle Creek (Shaver and Sunderman, 1983). At NSL, shallow (to approximately elevation 850 feet) groundwater flow directions are affected by discharge to Finley Creek and unnamed ditch. The Finley Creek discharge areas south and east of the site and the unnamed ditch west of the site cause groundwater to flow radially outward from the northeast corner of the landfill (Figure 1-4). Groundwater in the till probably discharges into the large sand and gravel lens beneath the southwest corner of the landfill, and then into Finley Creek and the unnamed ditch. At other locations, groundwater in the till probably discharges directly into Finley Creek and the unnamed ditch.

Groundwater beneath ECC appears to move south and discharge to Finley Creek or the unnamed ditch near its confluence with Finley Creek. Groundwater along the southeast edge of the ECC site appears to move in an eastern direction and discharge into the unnamed ditch. Based on the groundwater contours in Figures 1-3 and 1-4, the unnamed ditch appears to be a groundwater discharge area between the ECC and NSL sites.

Groundwater discharge areas have been identified as areas where upward gradient conditions exist or where the water



LEGEND

● ECC-7A REMEDIAL INVESTIGATION MONITORING WELL

882 CONTOURS FOR DECEMBER 1984 DATA

NOTE: Map represents topography and onsite features prior to surface cleanup.

All well locations are approximate.

0 100 200
50 150
SCALE IN FEET

FIGURE 1-3
SHALLOW SAND AND GRAVEL UNIT
GROUNDWATER CONTOUR PLAN
DECEMBER 1984
ECC-NSL CAA

NOTES: SOLID LINES interpolated from water levels at wells measured in August 1985.

DASHED LINES modified from results of steady-state computer simulation of groundwater flow using recharge rate of 10in./yr. over the landfill area.

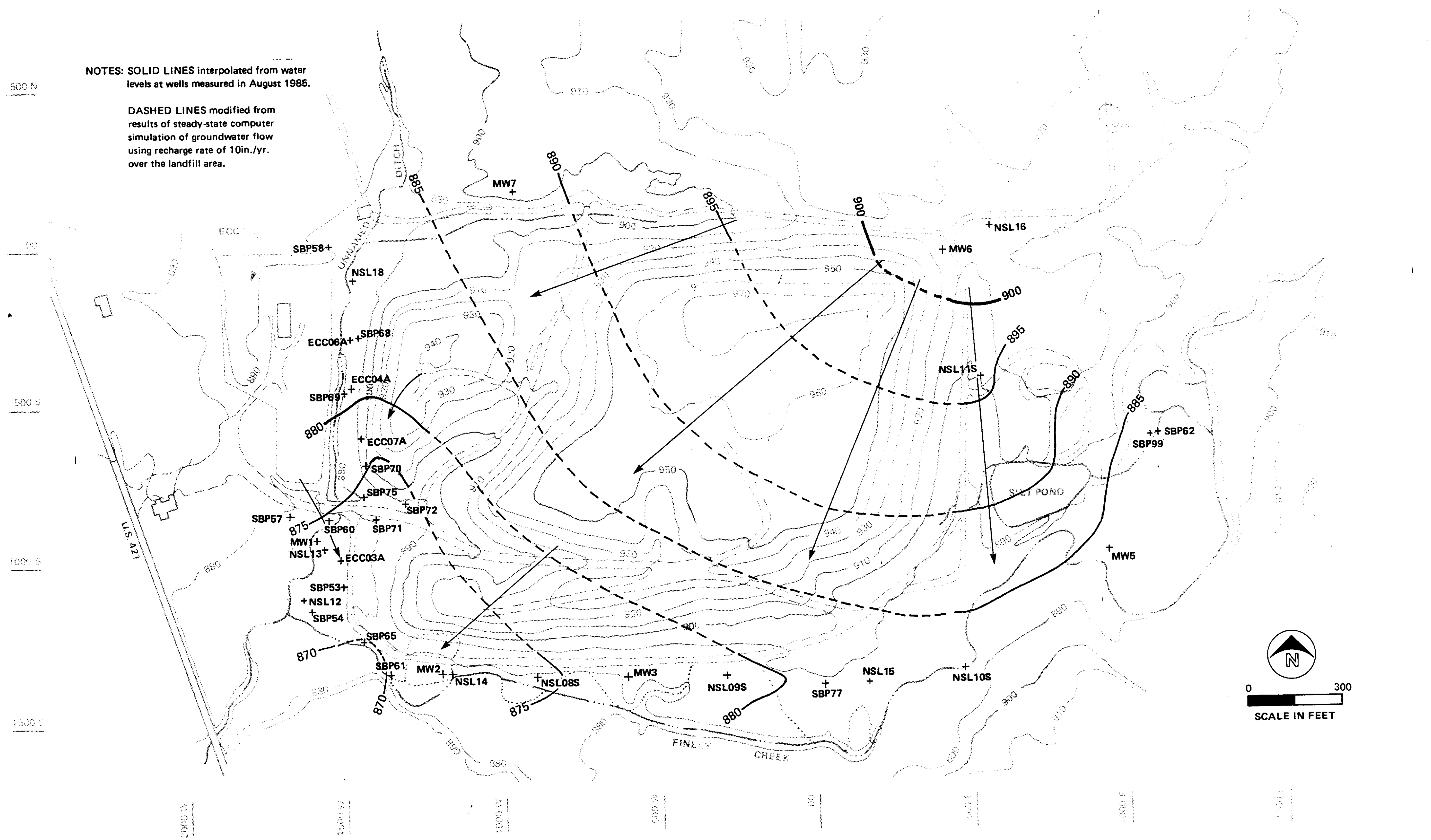


FIGURE 1-4
GLACIAL TILL UNIT
GROUNDWATER CONTOUR PLAN
ECC-NSL CAA

table is higher than the water levels in Finley Creek or the unnamed ditch. Almost all locations along Finley Creek and the unnamed ditch satisfy at least one of these conditions. However, the potential for groundwater to flow underneath the creek does exist. Water level measurements at comparable depths on both sides of the creek are needed to confirm it as a discharge area. This work requires the placement of nested wells on the south side of Finley Creek.

Groundwater level measurements from the deep confined water-bearing unit indicate a general north to south direction of groundwater movement. The potentiometric surface of the unit is above the ground surface, which indicates that the vertical hydraulic gradient from the deep confined unit is upward.

West (1982) reports the hydraulic conductivity of the silty-clay portions of the glacial till unit to be on the order of 10^{-8} to 10^{-9} cm/s. The hydraulic conductivities of lenses of coarse-grained deposits within the till have been estimated to be on the order of 10^{-2} to 10^{-4} cm/s (see NSL FS Report Appendix B). The difference in hydraulic conductivities of the till and coarse-grained lenses, coupled with the horizontal bedding of the coarse-grained lenses, results in a preferential horizontal groundwater flow direction.

Based on computer modeling results (see NSL FS Report, Appendix B), the water table in the till beneath the NSL site may be mounded, but when the computed mound elevations are compared with the prelandfill surface contours, only localized contact between groundwater and the landfilled refuse is expected. If the mound extends into the fill, it is unlikely that the saturated thickness within the fill is large because of the typically permeable nature of refuse. A limited thickness of perched water and leachate may exist at the interface between the landfill refuse and the ground surface. Perched fluid within the landfill proper (above the till) may be the primary source for leachate springs on the landfill sides.

NATURE AND EXTENT OF SITE CONTAMINATION

ECC Site

RI Results. Onsite soil sample inorganic analysis results showed only antimony, cadmium, cobalt, copper, lead, manganese, and zinc were present at concentrations exceeding their typical range in soil. Of these, cadmium, lead, and zinc were reported in more than one sample at concentrations exceeding their typical range in soils. Exceeding typical ranges in soil samples of inorganic constituents beneath the concrete pad is considered minor relative to the soil contamination in the northern drum and tank storage areas.

Inorganic contamination of the soil is apparently greatest in the near-surface (0-3 feet) soil in northern portions of the site. Inorganic contamination does appear to extend to depths of at least 5 feet in the northern portions of the site, although it is less widespread with depth than observed in the overlying near-surface soil.

Primary organic contaminants found in site soils are volatile organic compounds (VOC's) and phthalates. These compound groups are the most widespread organic contaminants and are generally present in the highest concentrations. Total VOC's ranged from 16 to 14,600,000 ug/kg. Total phthalates ranged from "not detected" to 370,000 ug/kg. Organic contamination decreases in the variety of compounds and their associated concentrations with depth. However, organic contaminants were detected to the maximum depth of sample analysis (8.5 feet).

Migration of soil contaminants to the water-bearing till has occurred onsite as evidenced by high levels of organic contaminants in one well onsite completed in the till. The sand and gravel deposit below the till has been shown to be contaminated with inorganics and organics in one well downgradient to the south of ECC and near the southwest corner of NSL and lesser amounts of organics in one well onsite and another immediately adjacent to and south of the site. Because of the presence of the NSL site east of ECC, the source of offsite contamination near the southwest corner of NSL could be either ECC or NSL. The offsite contaminants are consistent with those found at both sites. Organic contamination in the other two wells is likely due to onsite soils at ECC since they are directly downgradient of ECC-contaminated soils.

Contamination of the sand and gravel deposit may have occurred either by vertical migration through the silty clay till onsite or through contaminated water and sediment in the former cooling water pond. The cooling pond had intersected the sand and gravel deposit before removal of contaminated water and sludge and backfilling with clean soil during removal actions.

The deep confined aquifer below the ECC site has not been found to be contaminated. Future migration of onsite contaminants to the deep aquifer is highly unlikely because of an upward vertical hydraulic gradient from the aquifer.

Migration of contaminants to the nearest residential wells north, west, and south of the ECC site is not indicated by the results of the residential well sampling.

Surface water sampling results indicate that cyanide at levels below 30 ug/l is the only inorganic contaminant found in the surface water of the unnamed ditch and Finley Creek. The source of the cyanide may be either NSL or both ECC and NSL since cyanide was also found upstream of ECC. Inorganic sediment contamination is limited to chromium and lead in the unnamed ditch and Finley Creek. Since these contaminants were found upstream as well as downstream of ECC, the source may be NSL. It is possible that downstream of ECC, these sediment contaminants could also have originated from ECC.

Organic contamination of offsite surface water was found in Finley Creek near Highway 421. Contaminants consist almost entirely of chlorinated hydrocarbons and may be from ECC. A sample in Finley Creek upstream of the ECC drainage area but downstream of NSL did not show organic contamination. Also, surface water ponded on the ECC silty-clay cap onsite was found to be contaminated with a variety of semivolatiles and VOC's. The Indianapolis Department of Public Works has also sampled Finley Creek near Highway 421 as well as at several locations in Eagle Creek. Samples taken in 1986 and analyzed for VOC's show similar VOC contamination in Finley Creek as that reported in the ECC RI report. Contamination of Eagle Creek was not found in any of the samples taken.

Sediment from Finley Creek near Highway 421 contained two VOC's and several semivolatiles at levels up to 300 ug/kg. Sediment samples upstream of ECC yet downstream of NSL did not show similar organic contamination. These data imply the source of the organic sediment contamination is ECC although sampling was not extensive enough to be certain.

<u>Contaminant Transport and Fate</u>. Analytical results of the remedial investigations characterize current site contamination. Future conditions assuming no action is taken at the ECC site were estimated based on potential transport pathways and the natural attenuation and degradation of contaminants. Transport and fate of selected VOC's, phenols, phthalates, and polychlorinated biphenyl's (PCB's) were estimated. Transport of inorganic constituents from the soil is considered negligible because of the low levels found and the anticipated adsorptive capacity of the onsite soils.

Degradation of VOC's in soil is highly variable. If leaching is prevented, most of the selected volatiles will degrade to below detectable levels relatively rapidly (possibly within 10 years). Several of the selected volatiles will take much longer to degrade to below detectable levels. Degradation products such as vinyl chloride, however, may pose new risks. Phenols and phthalates in the subsurface soil are already at trace levels. PCB's will tend to persist in the soil at the site.

Under existing site conditions, the volatiles, phenols, and certain phthalates will tend to leach from subsurface soil into the groundwater and slowly migrate to the unnamed ditch or Finley Creek (PCB's and most phthalates will likely only leach in trace amounts). Estimates for travel time vary from 10 years to over 1,000 years depending upon the compound, hydraulic conductivity, and travel distance. Once in the surface waters, contaminants will either volatilize, adsorb to sediment, degrade, or experience dilutions on the order of 20:1 before reaching the Eagle Creek Reservoir, about 9 miles downstream.

NSL Site

Specific contaminant types and quantities disposed of at the NSL site are largely unknown. Data are also unavailable to locate the burial areas within the 70-acre landfill with the exception of the oil separation lagoon.

Soil samples collected from the surface and subsurface soil samples from around the periphery of the landfill did not show inorganic concentrations above background soil concentrations. Organic contamination was not found in the surface soil samples of the landfill cover material. Organic contamination of subsurface soil was found in borings nearest the landfill in the southern and southwestern portion of the site. The major organic contaminants found were VOC's and semivolatiles. VOC's detected included toluene, trichloroethene, and trans-1,2-dichloroethene at concentrations of about 10 to 51 ug/kg. One boring, however, contained toluene at 140,000 ug/kg. Semivolatiles were detected at concentrations of 300,000 to 400,000 ug/kg.

Leachate seeps, leachate sediment, and leachate collected in the existing leachate collection system at NSL were found to have inorganic and organic contamination. Inorganic contaminants found in leachate include chromium, nickel and lead. Organic contaminants in leachate included a variety of VOC's reaching 44,000 ug/l and semivolatile concentrations reaching 650 ug/l. Organic contaminants in leachate sediment included VOC's up to 760 ug/kg and semivolatiles up to 90,000 ug/kg.

Groundwater VOC contamination was found at all shallow NSL wells screened in the glacial till. VOC concentrations were as high as 1,100 ug/l. Semivolatiles were also found in nearly all wells in the glacial till though concentrations of individual compounds did not exceed 100 ug/l. Numerous VOC's were detected in the sand and gravel near the southwestern portion of the site at concentrations up to 100 ug/l. Because this area is also downgradient from ECC, contamination would be from ECC, NSL, or a combination of the two.

Inorganic contamination of groundwater in the glacial till and the sand and gravel in the southwestern corner of the NSL site included lead and nickel above background levels at several wells. Arsenic, chromium, and cyanide were also found at levels above background in at least one well.

Surface water and sediment contamination in the unnamed ditch and Finley Creek were described for the ECC site. In addition to the contaminants discussed, PCB's were detected in sediment of the old Finley Creek beds south of NSL at 1,800 ug/kg.

Contaminant Transport and Fate. Since the contamination within the landfill cannot be quantified, it is not possible to estimate future releases of contaminants nor the resulting effects on the surrounding media. Contaminant types and concentrations in the future may be very different from those currently observed in the monitoring wells and soil samples taken along the site perimeter. Over time, contaminants at the site perimeter would be expected to increase to a maximum level and then decline to background concentrations. The RI data do not show whether contaminant levels are on the increase or decrease at the NSL site. In addition, reliable estimates of the future leachate concentration and the time period from the initial landfilling to maximum groundwater contaminant levels, or to background levels, cannot be made.

It is possible that if contaminant types or levels increase, the time period before which concentrations permanently decrease to nonhazardous levels may be 100 years or longer. This unknown time period must be considered when evaluating remedial action alternatives.

Limitations of the Feasibility Study

Knowledge regarding the extent and degree of offsite contamination is limited by these factors:

- Groundwater from both sides of Finley Creek is believed to discharge into the creek; wells (or piezometers) will be installed south of the creek to confirm this assumption.

- Landfill gas was not sampled and analyzed and therefore cannot be confirmed as a hazard either onsite or offsite.

- The inability to predict future contaminant levels from NSL.

The first two of these data gaps should be filled before final design of remedial actions.

SUMMARY OF THE ENDANGERMENT ASSESSMENT

The endangerment assessments found that under the no action alternative potential risks to human health and the environment exist at the ECC and NSL sites. The affected media are soil and landfill contents, leachate, groundwater and surface water and sediment. They were assessed based on comparison of concentrations at potential exposure points to excess lifetime cancer risks, acceptable daily intake values, and relevant or applicable standards, criteria, or guidelines. The NSL assessment did not quantitatively assess exposures that could occur as a result of new releases of contaminants from the landfill, because the nature, quantity, and locations of hazardous wastes within the landfill are not known. An excess lifetime cancer risk of 1×10^{-6} is often used to reflect a level of concern for carcinogen risk.

The risk analysis performed for the endangerment assessment is conservative and tends to reflect upper bound exposures. However, given the uncertainty in both risk estimation and fate and transport calculations, the actual risks may be lower or higher than estimated. Summaries of the risks associated with the ECC and NSL sites are presented in Tables 1-1 and 1-2, respectively.

The exposure pathway potentially affecting the greatest number of people is release of contaminants to Finley Creek from groundwater or landfill leachate and their subsequent transport to Eagle Creek Reservoir. Current contaminant concentrations measured in groundwater and in Finley Creek do not result in levels posing a threat to human health when they reach the drinking water intake of the reservoir. This is based on the evaluation of contaminant concentrations assuming dilution only. Further reductions in contaminant levels would be expected from volatilization, adsorption, and degradation. Contaminant concentrations in groundwater and in Finley Creek, however, could increase in the future either as a result of contaminant migration from source areas or as a result of new contaminants created in degradation processes. It is possible that threats to human health could occur in the future for the population served by the Eagle Creek Reservoir.

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Table 1-1 (Page 1 of 2)
SUMMARY OF ECC EXPOSURE PATHWAYS
AND ASSOCIATED RISKS

Operable Unit	Exposure Pathways	Associated Risks
SOIL		
o Surface Soil	Direct contact, inhalation, and ingestion of surface contaminants. Transport of contaminants offsite as dust and runoff.	Soil cover material was not found to be contaminated before placement onsite. Contaminated ponded water on the cover indicates cover may contain contaminants. Potential exists for adverse health effects though data does not exist to quantify risk.
o Subsurface Soil	Future development onsite or erosion could result in direct contact, inhalation, and ingestion of contaminants.	If development or erosion occur, potential for adverse health effects from exposure exists. Excess lifetime cancer risks for ingestion range from 4×10^{-3} to 8×10^{-6}; however, development in close proximity to a landfill is not considered likely.
GROUNDWATER	Installation of potable well within the zone of contamination could result in direct contact, inhalation, and ingestion of contaminants.	Potential for adverse health effects from long-term exposure; several MCL's exceeded. Excess lifetime cancer risks range from 4×10^{-1} to 7×10^{-5} for ingestion of current or projected groundwater contaminants. Excess lifetime cancer risks range from 4×10^{-1} to 7×10^{-7} for dermal absorption of current or projected contaminant concentrations.

Table 1-1 (Page 2 of 2)

Operable Unit	Exposure Pathways	Associated Risks
	Discharge of contaminants to surface waters.	Potential for adverse health effects from ingestion of fish bioconcentrating contaminants at projected surface water concentrations. Excess lifetime cancer risk of 1×10^{-6} to 3×10^{-6}. Projected concentrations exceed WQC for protection of human health from ingestion of aquatic organisms.
		Current or projected concentrations of contaminants in surface water do not result in a threat to aquatic life as measured by ambient water quality criteria and LC_{50} values.
	Possible migration of contaminants to a deep aquifer.	Groundwater gradients are upward and this pathway is not possible.
SURFACE WATER AND SEDIMENT	Direct contact, inhalation and ingestion of contaminants.	Excess lifetime cancer risk from dermal absorption of VOC's in surface water is less than 1×10^{-6}.
	Transport of contaminants downstream to Eagle Creek Reservoir.	Current or projected future concentrations in surface water and sediment do not suggest a threat to human health via ingestion. Degradation products, such as vinyl chloride, however, may increase in the future and could pose a threat to human health.

Table 1-2 (Page 1 of 4)
SUMMARY OF NSL EXPOSURE PATHWAYS
AND ASSOCIATED RISKS

Operable Unit	Exposure Pathways	Associated Risks
Soil and Landfill Contents		
o Landfill Surface	Direct contact, inhalation, and ingestion of surface contaminants. Transport of contaminants offsite as dust and runoff.	None. Based on a limited number of samples, the landfill surface does not appear to be contaminated.
o Landfill Contents and Subsurface Soil	Future development onsite or erosion of the landfill surface could result in direct contact, inhalation, and ingestion of contaminants.	Potential exists for adverse health effects; however, development in the proximity of the landfill is highly unlikely.
o Leachate Sediment and Sediment in Old Creek Beds of Finley Creek	Direct contact, inhalation, and ingestion of contaminants. Transport of contaminants as dust and runoff.	Potential exists for adverse health effects resulting from long term exposure to contaminants. This is based on one leachate sediment sample which contained lead and chlordane and one creek bed sediment sample which contained PCB's.

Operable Unit	Exposure Pathways	Associated Risks
Leachate		
o Leachate Seeps	Direct contact, inhalation, and ingestion of contaminants. Discharge of contaminants to surface waters.	Current risk to public health and environment is negligible since long term ingestion and use of the leachate liquid is highly unlikely. However, leachate seeps represent the potential for future release of contaminants which could result in adverse health effects for humans and adverse effects on the aquatic ecosystem in the surface waters.
o Leachate Liquid in Collection System	Direct contact, inhalation, and ingestion of contaminants.	Current risk to public health and environment is minimal since long term exposure is highly unlikely. Potential exists for contamination to increase from future releases.
o Landfill Liquid	Future development onsite could result in direct contact, inhalation, and ingestion of contaminants.	Potential exists for adverse health effects; however, development in the proximity of the landfill is highly unlikely.

Operable Unit	Exposure Pathways	Associated Risks
Groundwater	Installation of a potable well within the zones of contamination could result in direct contact, inhalation, and ingestion of contaminants.	Potential for adverse health effects from long-term exposure; however, installing a potable well on or near the landfill is unlikely. Several MCL's exceeded excess lifetime cancer risk of 1×10^{-3}.
	Discharge of contaminants to surface waters.	Concentrations of contaminants in groundwater do not currently suggest a threat to aquatic life as measured by ambient water quality criteria and LC_{50} values. However, potential for increasing contaminant types or levels in groundwater and surface water could result in adverse effects on public health and aquatic life.
	Possible migration of contaminants offsite.	Groundwater is believed to discharge to Finley Creek. In this case, risk from offsite migration is negligible. If additional investigations indicate that groundwater is flowing under Finley Creek and to the south, the risk would be reevaluated.
	Possible migration of contaminants to a deep aquifer.	Based on data from ECC site investigation, the gradients are upward and this pathway is not possible.

Operable Unit	Exposure Pathways	Associated Risks
Surface Water and Sediment	Contact or assimilation of contaminants by aquatic life.	Concentrations of contaminants in the surface waters and sediment do not currently suggest a threat to aquatic life as measured by ambient water quality criteria and LC_{50} values. However, potential for increasing contaminant types or levels in groundwater and surface water could result in adverse effects on public health and aquatic life.
	Direct contact, inhalation, and ingestion of contaminants.	Concentrations of contaminants in the surface waters and sediments do not currently suggest a threat to human health. Ingestion and use of water in Finley Creek and the unnamed ditch are highly unlikely. Increases in contaminant types or levels in future could result in adverse health effects.
	Transport of contaminants downstream to Eagle Creek and Eagle Creek Reservoir, a water supply source.	Concentrations of contaminants in the surface waters and sediment do not currently suggest a threat to human health. Future release of contaminants to the surface waters may change the concentrations and risk to public health could occur.

Chapter 2
ASSEMBLY OF REMEDIAL ACTION ALTERNATIVES

Remedial action goals are developed and presented in the ECC and NSL FS Reports to address each of the site hazards identified for the sites. These goals are summarized in this chapter and are the basis for the combination of alternatives presented later.

REMEDIAL ACTION GOALS

Remedial action goals are identified for each of the following operable units: soil and landfill contents, landfill leachate, groundwater, and surface water and sediment.

Remedial Goals for Soil and Landfill Contents

- Minimize Direct Contact--Minimize risk to public health and environment from direct contact inhalation or ingestion of NSL landfill contents, contaminated surface or subsurface soil on ECC and NSL, NSL leachate sediment and sediment in the old creek beds of Finley Creek.

Remedial Goals for Leachate

- Minimize Direct Contact--Minimize risk to public health and environment from direct contact with NSL leachate liquid in the collection system and leachate seeping from the sides of the landfill.

- Control Migration to Groundwater--Minimize and mitigate leaching of contaminants from the ECC contaminated soil or the landfill contents into the groundwater to adequately protect health of potential receptors using the groundwater at or near the site.

- Control Migration to Surface Water--Minimize and mitigate the overland migration of contaminants from leachate seeps to the unnamed ditch and Finley Creek to adequately protect public health and environment from surface water and sediment contamination, ingestion of contaminated aquatic life, and direct contact with leachate liquid.

Remedial Goals for Groundwater

- Minimize Direct Contaminant Consumption--Minimize current and possible future risk to public health from direct consumption of contaminated groundwater.

- o Control Migration to Surface Water--Manage migration of contaminated groundwater to the unnamed ditch and Finley Creek so public health and environment are adequately protected from surface water and sediment contamination and ingestion of contaminated aquatic life.

Remedial Goals for Surface Water and Sediment

- o Control Migration to Surface Water--Minimize and mitigate the threat to the environment and public health from direct contact, inhalation, and ingestion of contaminants in surface water and sediment resulting from future release of hazardous substances from landfill leachate and groundwater discharge.

ASSEMBLY OF REMEDIAL ACTION ALTERNATIVES

Alternatives developed for the NSL and ECC sites and described in detail in the respective feasibility studies are listed in Table 2-1. This table presents a matrix of alternatives versus major technologies and the combined alternatives for the CAA. Since each of the NSL or ECC alternatives contains many individual components, the possible combinations far exceed the eight CAA alternatives developed. The CAA alternatives are intended to represent a wide range, both in terms of cost and public health and environmental benefits, of alternatives that are applicable to meeting the remedial action goals. Numerous variations of the alternatives are possible and should be considered when selecting the preferred alternative.

OBJECTIVES OF ALTERNATIVES

The main objectives of each CAA alternative are discussed below. The alternatives are described in detail later in this chapter.

Alternative 1--No Action

The No Action Alternative is required by the NCP to be carried forward. It provides a baseline for comparison of other alternatives.

Alternative 2--Access Restrictions With Soil Cover and Leachate Collection and Treatment

Alternative 2 includes deed restrictions, fencing, a soil cover over the landfill to promote revegetation, a soil cover over the ECC site, disposal of sediment on NSL, rerouting

	NSL ALTERNATIVES							ECC ALTERNATIVES							CAA ALTERNATIVES								
	No Action	Access Restrictions with Soil Cover and Leachate Collection and Treatment	Access Restrictions with RCRA Cap and Leachate Collection and Treatment	Access Restrictions with Soil Cover, Leachate Collection, Groundwater Interception and Treatment	Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Interception and Treatment	Access Restrictions with.RCRA Cap, Leachate Collection,Groundwater Isolation and Treatment	Access Restrictions with Onsite RCRA Landfill	No Action	Access Restrictions	Capping	Groundwater Collection and Treatment	Groundwater Collection and Treatment--Soil Vapor Extraction	Soil Excavation and Disposal Offsite--Groundwater Collection and Treatment	Soil Excavation with Onsite Incineration and Onsite Disposal--Groundwater Collection and Treatment	No Action	Access Restrictions with Soil Cover and Leachate Collection and Treatment	Access Restrictions with RCRA Cap and Leachate Collection and Treatment	Access Restrictions with Soil Cover, Leachate Collection, Groundwater Interception and Treatment	Access restrictions with RCRA Cap, Leachate Collection, Groundwater Interception and Treatment	Access Restrictions with RCRA Cap, Leachate Collection,Groundwater Isolation and Treatment	Access Restrictions with RCRA Cap, Leachate Collection,Groundwater Isolation and Treatment and ECC Soil Vapor Extraction	Access Restriction with RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment and ECC Soil Incineration	Access Restrictions with Onsite RCRA Landfill
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9
ACCESS RESTRICTIONS Deed Restrictions, Fencing and Long-Term monitoring of groundwater, leachate, unnamed ditch and Finley Creek		X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X
SURFACE CONTROLS Excavating/Capping old Creek beds and rerouting unnamed ditch and Finley Creek		X	X	X	X	X	X									X	X	X	X	X	X	X	X
Soil Cover (Silty Clay)		X		X							X	X	X	X		X		X					
CONTAINMENT RCRA Cap			X		X	X	X			X							X		X	X	X	X	X
SOIL REMOVAL/DISPOSAL Landfill Excavation and Onsite disposal in RCRA Landfill							X																X
ECC soil excavation and offsite disposal at RCRA facility													X										
SOIL TREATMENT/DISPOSAL ECC soil insitu treatment with soil vapor extraction												X									X		
ECC soil incineration and disposal onsite														X								X	
LEACHATE COLLECTION French drain system along NSL perimeter		X	X	X	X	X										X	X	X	X	X	X	X	
GROUNDWATER COLLECTION French drain and extraction well system to intercept groundwater before migration offsite				X	X						X	X	X	X				X	X⊛				
French drain and extraction well system to lower water table below zone of soil contamination						X														X	X	X	
LEACHATE/GROUNDWATER TREATMENT Precipitation biological treatment and carbon adsorption treatment with discharge to Finley Creek		X	X	X	X	X										X	X	X	X	X	X	X	X
Granular Activated Carbon Treatment with discharge to Finley Creek											X	X	X	X									

⊛ COLLECTION SYSTEM CONSISTS OF FRENCH DRAINS ONLY

TABLE 2-1
ASSEMBLY OF NSL, ECC, AND CAA ALTERNATIVES
ECC-NSL CAA

the surface waters, collection and treatment of the leachate seeps, and monitoring of the leachate, groundwater, and surface water. This alternative addresses all of the operable unit goals with two exceptions. It would not mitigate or minimize the leaching of contaminants from the landfill to the groundwater nor would it manage the migration of groundwater to the surface waters. The intent was to present a low-cost alternative that offers the lowest level of protection to public health and the environment. If contaminant concentrations in the proposed monitoring wells exceed applicable and relevant and appropriate requirements (ARAR's) limits, future remedial actions would be initiated.

Alternative 3--Access Restrictions With RCRA Cap and Leachate Collection and Treatment

Alternative 3 is identical to Alternative 2 with the exception of a RCRA cap over both sites in place of a soil cover. This alternative is intended to provide a greater level of protection by reducing contaminant migration to the groundwater through reduction in surface water infiltration while also meeting technical requirements of landfill capping for site closure under RCRA. Monitoring would still be necessary to detect migration of contaminants in the groundwater. The quantity of leachate migrating to the groundwater will be reduced significantly; however, the potential for future contamination of the groundwater remains. As with Alternative 2, if contaminant concentrations in the proposed monitoring wells exceed ARAR's, future remedial actions would be initiated.

Alternative 4--Access Restrictions With Soil Cover, Leachate Collection, Groundwater Interception, and Treatment

Alternative 4 is essentially identical to Alternative 2 with the addition of groundwater interception to mitigate the migration of groundwater contaminants offsite or to the surface waters. This alternative addresses the groundwater and surface water operable unit goals of providing adequate protection of public health and the environment from future contamination of the surface water. Leachate from NSL would continue to migrate to the groundwater so collection and treatment would be required indefinitely at NSL. At ECC, soil contaminants which leach to groundwater would be removed and treated, though treatment would also likely be required indefinitely (possibly for 100 years or more).

Alternative 5--Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Interception, and Treatment

Alternative 5 includes leachate and groundwater interception and treatment with a RCRA cap over the sites. The objective of the cap is to minimize further leaching of soil or landfill contaminants to the groundwater. This may eventually allow termination of the groundwater collection and treatment system, though leachate collection and treatment would continue to be necessary. The operational period of the collection and treatment system cannot be reliably estimated but would be less than the 100 years or more required for Alternative 4.

Alternative 6--Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment

Alternative 6 employs a groundwater collection system intended to lower the water table beneath the contaminated or potentially contaminated zones at both sites. Combined with a RCRA cap the alternative should eventually prevent further contamination of the groundwater and result in groundwater treatment of leachate only. However, the collection system would be operated indefinitely to maintain the lower water table. This alternative is intended to provide a greater level of protection to the public health and environment by reducing contaminant migration.

Alternative 7--Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Vapor Extraction

Alternative 7 incorporates all the components and objectives of Alternative 6 with the additional treatment of ECC-contaminated soil. Because the alternative includes a RCRA cap over ECC combined with a lowering of the water table, the soil vapor extraction treatment would not likely result in a reduced groundwater treatment period relative to Alternative 6. This is because in either alternative leaching of soil contaminants to the groundwater is minimized by the cap and the lowering of the water table. The public health risk from direct contact with ECC-contaminated soil in the event of site development would be greatly reduced.

Alternative 8--Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration

Alternative 8 incorporates the objectives of Alternative 7. ECC-contaminated soil, however, is treated by onsite incineration. This results in permanent destruction of organic contaminants.

Alternative 9--Access Restrictions With Onsite RCRA Landfill

Alternative 9 includes deed restrictions; excavation of the landfill contents, peripheral soils, sediments and ECC-contaminated soil; and disposal of the waste materials in an onsite RCRA-type facility. This alternative addresses all the operable unit goals and provides the highest level of protection of all the alternatives. However, the risks of exposure during construction and implementation would be greater than any of the other alternatives.

ALTERNATIVE COMBINATIONS NOT INCLUDED

Several potential combinations of NSL and ECC alternatives were not included since they either did not satisfy the remedial action goals, or other combinations better satisfied the objectives intended. They are discussed below.

ECC Soil Excavation and Disposal Offsite

This soil operable unit response action of ECC Alternative 6 was not included in any CAA Alternative since it is costly (30-year present worth of $3,700,000) and does not result in destruction of contaminants.

Incineration of NSL Landfill Contents and Contaminated Soil

Incineration of NSL landfill materials and contaminated soils was eliminated as a viable technology in the NSL FS Screening (see NSL FS Chapter 3). Several disadvantages of incinerating the entire NSL landfill are: the risk of exposure to contaminants during excavation, unknown contents of the landfill, lengthy time to implement and incinerate the solids, and the high cost (capital cost is estimated to be $3 billion to $5 billion. Incineration of isolated and heavily contaminated areas within the landfill could be accomplished at a much lower cost if such areas could be effectively located. Risks of exposure or offsite migration of contaminants during excavation would still be important disadvantages.

NCP ALTERNATIVE CATEGORIES

The NCP identifies several categories under which at least one alternative should be developed, to the extent that it is possible and appropriate. The categories are:

1. Alternatives for treatment or disposal at an offsite facility.

2. Alternatives that attain applicable or relevant and appropriate Federal public health and environmental requirements.

3. Alternatives that exceed applicable or relevant and appropriate Federal public health and environmental requirements.

4. Alternatives that do not attain applicable or relevant and appropriate Federal public health and environmental

requirements but will reduce the likelihood of present or future threat from the hazardous substances and that provide significant protection to public health and welfare and the environment. This must include an alternative that closely approaches the level of protection provided by the applicable or relevant appropriate requirements.

5. No Action alternative.

Table 2-2 shows the alternatives applicable to each category.

DETAILED DESCRIPTION OF ALTERNATIVES

ALTERNATIVE 1--NO ACTION

As stated previously, the No Action alternative is required by the NCP and provides a baseline for comparison of other alternatives. This alternative would result in the public health and environmental risks identified in the endangerment assessment.

ALTERNATIVE 2--ACCESS RESTRICTIONS WITH SOIL COVER AND LEACHATE COLLECTION AND TREATMENT

The major components of Alternative 2 are:

- Access restrictions
- Soil cover and surface controls
- Monitoring
- Leachate collection
- Treatment

The site plan of Alternative 2 is shown in Figure 2-1.

Access Restrictions

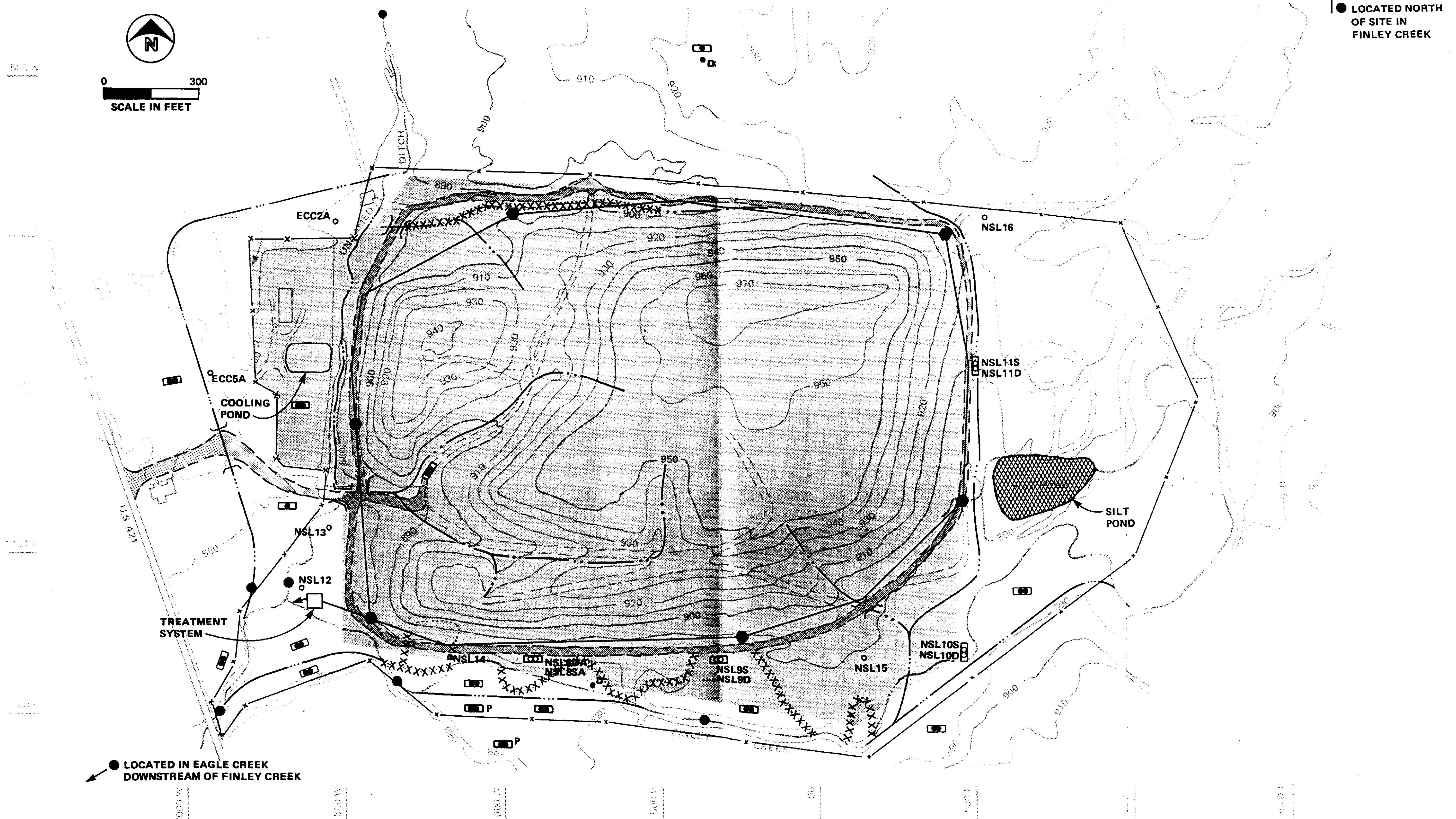
Deed restrictions would be placed on the landfill property and would include the ECC site. The restrictions would prevent future development of the land to protect against direct contact with contaminants or further migration that would result from site excavation. The deed restrictions would also prohibit use of groundwater or installation of wells onsite. Access to the site would be controlled by completing the fencing around the site perimeter and posting of signs.

Soil Cover and Surface Controls

A soil cover and vegetation would be installed over the landfill and the ECC site to prevent erosion. The cover would increase evapotranspiration by allowing vegetative growth and prevent water ponding onsite. Prior to placing the cover, the sites would be graded to fill existing depressions,

Table 2-2
NCP ALTERNATIVE CATEGORIES

NCP Alternative Category	CAA Alternatives 1	2	3	4	5	6	7	8	9	Comments
1. Treatment or disposal at an offsite facility.										There is no reasonably implementable offsite disposal technology applicable to the landfill and ECC because of the large volume of waste material to be transported. Collection and offsite treatment of leachate and groundwater is possible but may be considerably more costly depending on pretreatment requirements and may not be implementable.
2. Attain applicable or relevant and appropriate Federal public health and environmental requirements.					X	X	X	X	X	These alternatives involve collection and treatment of leachate and groundwater to meet applicable criteria and include a RCRA type cap.
3. Exceed applicable or relevant and appropriate Federal public health and environmental requirements.								X	X	Incineration of ECC soil would exceed Federal requirements. Alternative 8 involves removing the sources of contamination and disposing of them in a RCRA-type landfill onsite.
4. Do not attain Federal requirements but reduce present or future threat and provide significant protection to public health, welfare or the environment.			X	X	X					Alternatives 2 and 3 may not attain Federal requirements since the groundwater is not collected and treated. Contaminants were detected in some wells at concentrations exceeding Safe Drinking Water Act Maximum Contaminant Levels (MCL's). Alternative 4 does not attain Federal requirements since it does not include a RCRA cap.
5. No Action.		X								Retained as a baseline for comparison.



LEGEND

- REROUTED CREEK
- NSL10S / NSL10D — EXISTING MONITORING WELL NEST
- NSL15 — EXISTING MONITORING WELL
- NEW MONITORING WELL NEST
- P — NEW PIEZOMETER NEST
- D — NEW DEEP WELL
- SURFACE WATER/SEDIMENT SAMPLING LOCATION
- MANHOLE
- NEW DITCHES
- CULVERT
- ROAD IMPROVEMENTS
- NEW FENCE
- NEW LEACHATE COLLECTION SYSTEM
- XXXXXXX SEDIMENT REMOVAL
- AREA OF SOIL COVER

FIGURE 2-1
ALTERNATIVE 2
ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION, AND TREATMENT
ECC-NSL CAA

eliminate sharp grade changes, and provide for site drainage. A 1-foot soil cover consisting of locally available till would be placed over the sites. The sites would be seeded with grass to prevent erosion and increase evapotranspiration.

About 4,200 cubic yards of leachate sediment and sediment in the ditch north of NSL and the old creek beds of Finley Creek would be excavated, dewatered, and disposed of onsite beneath the soil cover. It was assumed that excavation to a 1-foot depth would be necessary. The creek beds would be backfilled and a soil cover would be placed over the area. Contaminated water resulting from the dewatering of the sediment would be treated in the onsite leachate treatment system.

The unnamed ditch would be rerouted to the west of ECC and portions of Finley Creek would be rechannelized as shown in Figure 2-1. This would route the surface waters farther away from contaminated areas and increase the travel time for contaminants to migrate in the groundwater to the surface waters, thus increasing the likelihood of contaminant attenuation and degradation.

Monitoring

Contaminant migration would be assessed through a regular leachate, groundwater, and surface water monitoring program. Leachate would be sampled at the leachate collection sump as part of the leachate collection and treatment system. Groundwater would be monitored using 15 of the existing wells and an additional 26 new monitoring wells (see Figure 2-1). The total of 41 monitoring wells would be sampled quarterly the first 5 years and analyzed for the full organic and inorganic priority pollutant list. Subsequent sampling would be reduced to twice per year at all 41 wells. Samples would be analyzed for VOC's, semivolatiles and inorganics. Water levels of monitoring wells would be taken at the time of sampling and gradients would be calculated and compared to existing data. Surface water and sediment would be sampled at eight locations semiannually. These samples would be analyzed for VOC's, base/neutrals, pesticides, PCB's, and inorganics. Depending on surface water results, fish could be occasionally collected from Finley and Eagle Creek and their tissues analyzed for bioaccumulation of organic contaminants.

Leachate Collection

The leachate collection system would consist of a French drain encircling the landfill. The drain would be about 4 feet deep and 6,000 feet in length. Perforated pipe laid in the trench would be used to transport leachate to one of the several sumps. The trench would be backfilled with gravel. A 1-foot layer of gravel would also be placed on the sideslopes of the landfill to provide a drainage path for leachate seepage. The soil cover described previously would extend over the gravel layer and the drainage trench. The existing leachate collection system would be abandoned. The leachate collection system is discussed in greater detail in the NSL FS Report, Chapter 4 and Appendix B.

Treatment

The estimated flowrate of the leachate collection system is 40 gpm. The leachate would be pumped to an onsite treatment plant consisting of precipitation, biological oxidation, and carbon adsorption (see Figure 2-2). Leachate contaminant types and concentrations are discussed in the NSL FS Report, Appendix A.

In the treatment system, the waste stream will first pass through the precipitation process for removal of metals and other inorganics. Chromium, copper, iron, lead, and zinc were detected in the groundwater and leachate samples and can be removed by precipitation. The precipitation will be induced by the addition of chemicals. Both hydroxide and sulfide precipitation can be used effectively. Hydroxide precipitation will be used for cost estimating purposes for several reasons. Operationally, hydroxide would be added regardless for pH control, so only one chemical addition system would be required. Further, the presence of sulfide can pose a health risk in the effluent discharge or as an emission of hydrogen sulfide. However, bench testing prior to design would be required to determine what the appropriate precipitant would be. A polymer can also be added to enhance solids settling. Flocculation and clarification will follow the chemical addition and can be accomplished in one basin. Either flocculation with lamella gravity settlers or solids contact clarifiers could be used. Sludge will be removed from the bottom of the basin and can be thickened, dewatered with a filter press, and disposed of in a RCRA landfill.

Effluent from the precipitation process will then go through powdered activated carbon treatment (PACT) which is a patented activated carbon enhanced biological treatment system. The PACT system combines biological treatment and carbon adsorption into one process. The system works through the addition of powdered activated carbon to the influent of the activated sludge process. The system consists of carbon feeding equipment, an aeration basin with the necessary appurtenances, a clarifier, and solids handling equipment. Solids would be wasted to an aerobic digester followed by dewatering. Solids would then be disposed of at a RCRA landfill unless they could be delisted as a nonhazardous waste. Spent carbon in the waste solids could be separated and regenerated offsite. Onsite regeneration facilities would not be cost effective, considering the small amount of carbon to be used.

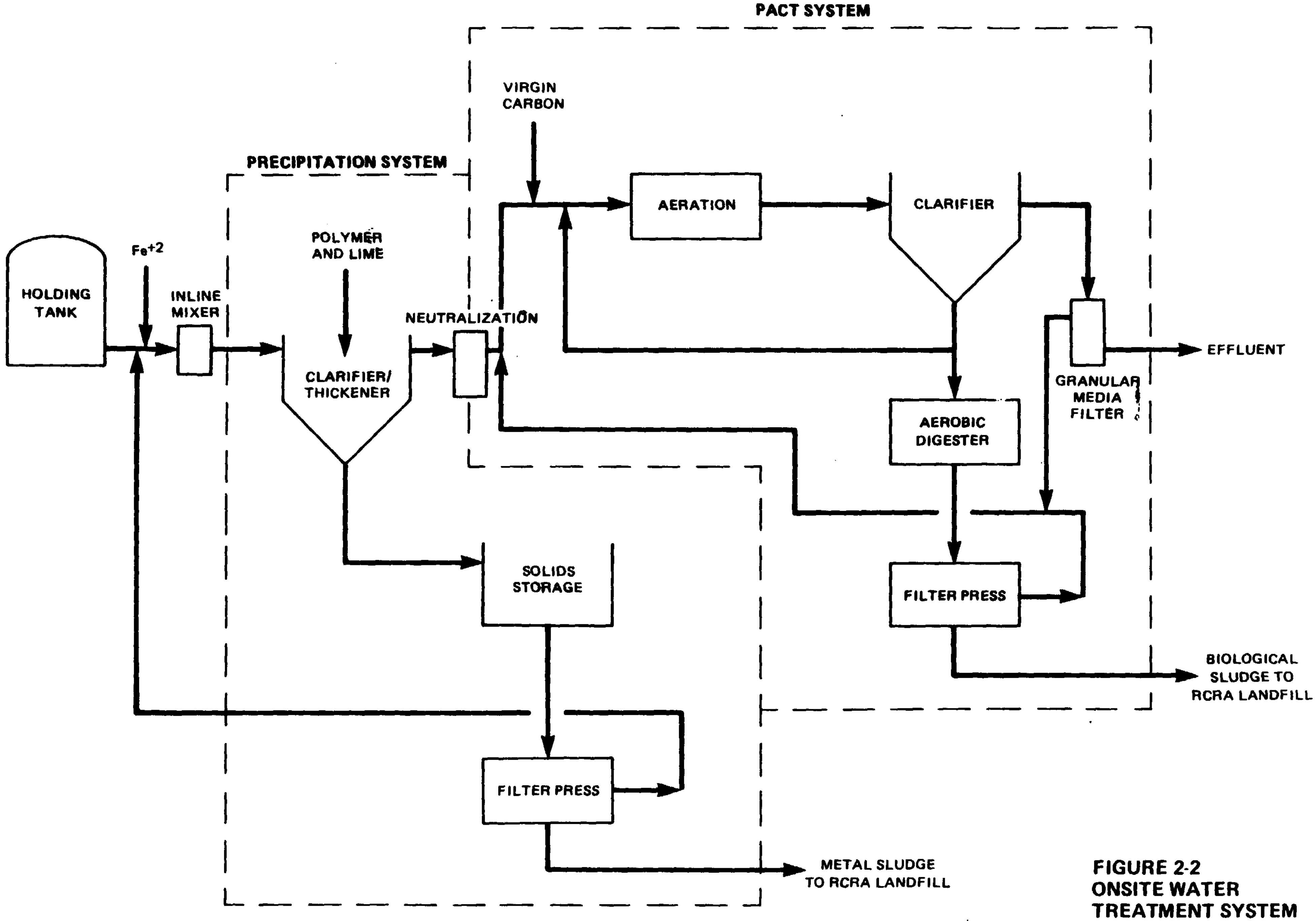


FIGURE 2-2
ONSITE WATER TREATMENT SYSTEM
ECC-NSL CAA

Granular media filtration would be included in the treatment system following either the precipitation system or the PACT system or both. The advantage of having a filter after each unit would be that less metals would carry over into the PACT system and that solids with low settleability would be removed from the biological system effluent. For costing purposes, however, it is assumed that one filter will be used after the PACT system. Development of the treatment system is based on limited data. Pilot-scale and bench-scale testing would be necessary prior to implementation.

Effluent Discharge

Discharge of treated leachate would be to Finley Creek southwest of the NSL site. Discharge limits for treatment effluent are set during the NPDES permit process. NPDES permitting is handled by the Indiana Department of Environmental Management, Office of Water Management Permit Section. There is no list of standards or criteria applicable for all waterways. The permit considers the water use designation for the receiving water, waste load allocations, relevant state water quality standards, federal water quality criteria, and other scientific data.

Finley Creek and Eagle Creek are "waters of the State of Indiana" and have been given the aquatic life (warm water fishery) and partial body contact recreation water use designation. Any discharge of treated leachate and groundwater should help maintain those uses.

Indiana water quality standards are presented in 330 IAC-1-6. The minimum water quality conditions include conditions governing substances that affect aesthetic conditions, are acutely or chemically toxic, or otherwise cause injury to humans, animals, aquatic life or plants. The minimum water quality conditions for aquatic life apply outside the mixing zone to substances that affect taste or odor, are toxic (1/10 of the 96-hour LC_{50}), or that may bioconcentrate to result in exceeding FDA action levels for fish consumption. Because both Eagle Creek and Finley Creek seasonally may have no or low flow, no mixing zone will be considered and effluent discharges will be compared directly to criteria.

Table 2-3 lists criteria that may be used in setting the discharge limits. The first two categories (1/10 LC_{50} and AWQC aquatic life) address aquatic population effects. The next category (AWQC aquatic life-human use) addresses human use of the fishery. The remaining criteria address human consumption of the water as a potable water source. Included for comparison purposes are the average concentrations of each contaminant detected in the leachate.

Table 2-3
WATER QUALITY CRITERIA APPLICABLE TO LEACHATE DISCHARGE

	Average Leachate Concentration (ug/l)	Applicable Criteria (ug/l): One-Tenth 96 hr LC[d]	Protection of Aquatic[e] Life: Acute	Protection of Aquatic[e] Life: Chronic	Consumption[e] of Aquatic Organisms	Drinking Water Act MCL's[f]	AWQC Drinking Water[g]
Benzene	106	2,440	5,300	-	40[b]	5	0.67[b]
Bis(2-Ethyl Hexyl)Phthalate	181	-	11,100	3	50,000[a]	-	21,000[a]
4-Chloro-3-Methyl Phenol	62	1.0	30	-	-	-	3,000[a]
1,1-Dichloroethene	3	-	30,300[a]	-	1.85[b]	7	0.033[b]
Methylene Chloride	1,250	19,300	193,000	-	15.7[b]	-	0.19[b]
Napthalene	20	15,000	23,000	620	0.0311[b]	-	-
Phenanthrene	20	-	-	-	0.0311[b]	-	0.0028[b]
Arsenic	6	-	360	190	0.0175	50	0.0025[b]
Chromium (+6)	18	-	16	11	3,433,000	50	50[a]
Copper	33	-	42[c]	26[c]	-	1,000	1,000[a]
Cyanide	-	-	22	5.2	-	-	200[a]
Iron	32,600	-	-	1,000	-	300	-
Lead	45	-	264[c]	10[c]	-	50	50[a]
Nickel	76	-	3,700[c]	192[c]	100	-	15.4[a]
Zinc	123	-	687[c]	47[c]	-	5,000	5,000[a]

[a] Based on toxicity concentration.
[b] Based on carcinogenic protection at the 10^{-6} cancer risk level.
[c] Contaminant concentration based on water hardness of 250 mg/l $CaCO_3$ equivalent.
[d] Based on published 96-hour median lethal concentration, (Verschueren, 1983).
[e] 1980 Federal Ambient Water Quality Criteria.
[f] Proposed maximum concentration level.
[g] 1980 Federal Ambient Water Quality Criteria for protection of human health at the 10^{-6} cancer risk level.
___ Underline designates the lowest AWQ.

NOTE: For calculation of average leachate concentrations, see NSL FS Report Appendix A.

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Because the NPDES permit process would consider all these factors, the feasibility study assumes treatment facility discharges must meet all of these categories.

Neither Finley Creek nor Eagle Creek are designated for domestic (potable water) uses. It does not appear that domestic use will be a reasonable future use of either creek. While Eagle Reservoir is a potable water source, permitted discharge to Finley Creek would undergo dilution of about 1,600 to 1 (assuming annual average daily flow at the reservoir of 150 cfs) by the time it arrives at the reservoir. Contaminant levels would be further reduced in the reservoir because of degradation and volatilization during the estimated minimum 45-day residence time. A conservative estimate of treatment system discharge limits for protection of drinking water use at the reservoir was made using the dilution factor multiplied by drinking water AWQC. The resulting values were all below the the applicable criteria underlined in Table 2-3. Therefore, meeting the underlined applicable criteria in Table 2-3, will result in meeting drinking water criteria applied to contaminants at the reservoir.

<u>Operation and Maintenance</u>

Maintenance would be required for the soil cover because of erosion, freeze/thaw, and landfill settlement. It was estimated that every fifth year, 10 inches of fill over 50 percent of the landfill would need replacement. Routine inspections of the landfill surface and the leachate collection system would be required semiannually.

The treatment system would require a full-time operator to perform testing and maintenance, to adjust chemical and carbon feed rates, and to ensure that all process units are functioning properly. To provide for regular maintenance or in the event of treatment system failure, a 100,000 gallon holding tank is included. This tank provides a 2-day holding time for untreated leachate.

<u>ALTERNATIVE 3--ACCESS RESTRICTIONS WITH RCRA CAP AND LEACHATE COLLECTION AND TREATMENT</u>

The major components of Alternative 3 are:

- o Access restrictions
- o Cooling pond sludge removal
- o RCRA cap and surface controls
- o Monitoring
- o Leachate collection
- o Treatment

The site plan of Alternative 3 is shown in Figure 2-3.

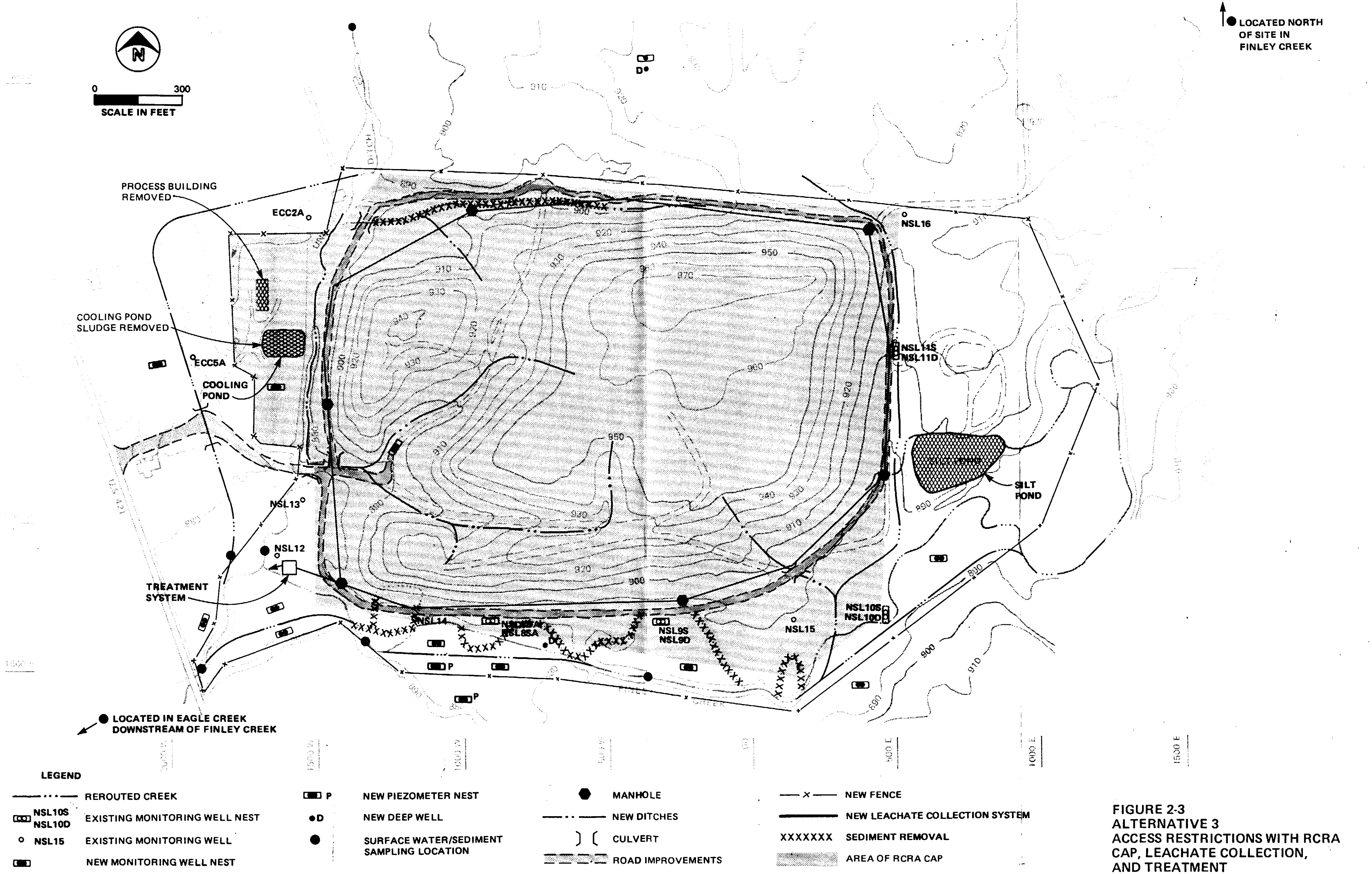


FIGURE 2-3
ALTERNATIVE 3
ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, AND TREATMENT
ECC-NSL CAA

Access restrictions, surface controls, monitoring, and leachate collection and treatment are similar to Alternative 2.

Cooling Pond Sludge Removal

Before construction of the cap, any contaminated sludge or soil remaining in the former ECC cooling pond would be excavated and disposed of at a licensed RCRA landfill. Soil samples would be collected from soil borings in the former cooling pond and analyzed to determine excavation locations and volumes. Excavated sludge or soil would be replaced with clean fill. Removal of remaining contaminated sludge would prevent any further contamination of the sand and gravel deposit provided groundwater gradients remain upward. Groundwater removed during sludge excavation would be transported and treated at a licensed RCRA facility.

RCRA Cap

The RCRA cap would cover the same area as the soil cover of Alternative 2. It would consist of 1 foot of soil overlying 1.5 feet of a sand and gravel drainage layer. Below these would be a 30-mil synthetic membrane, 2 feet of clay, and 1 foot of sand (for gas collection on the landfill only). Prior to placing the cap, the site would be graded to eliminate sharp grade changes and to provide for drainage. Also the former process building on the ECC site would be demolished. The concrete floor and foundation would remain and the cap placed on top. The cap would be seeded to control erosion and promote evapotranspiration.

The RCRA cap is expected to reduce the rate of leachate production from 40 gpm to 5 gpm within 5 years. The resulting flowrate requiring treatment would also decrease from 40 gpm to 5 gpm.

Operation and Maintenance

Maintenance for Alternative 3 will be similar to Alternative 2. Repair and replacement of the RCRA cap will be required as with the soil cover and routine inspections of the cap and collection system would be necessary or a regular basis. A full-time operator would be required for the treatment system.

ALTERNATIVE 4--ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT

The major components of Alternative 4 are:

- Access restrictions
- Cooling pond sludge removal
- Soil cover and surface controls

- Monitoring
- Leachate collection
- Groundwater interception
- Treatment

The site plan for Alternative 4 is shown in Figure 2-4.

Access restrictions, soil cover and surface controls, leachate collection, and treatment are similar to Alternative 2. Cooling pond sludge removal would be as described in Alternative 2, although contaminated water removed during excavation could be treated in the onsite treatment system. Alternative 4 includes a groundwater collection system to intercept groundwater migrating to the surface waters or offsite.

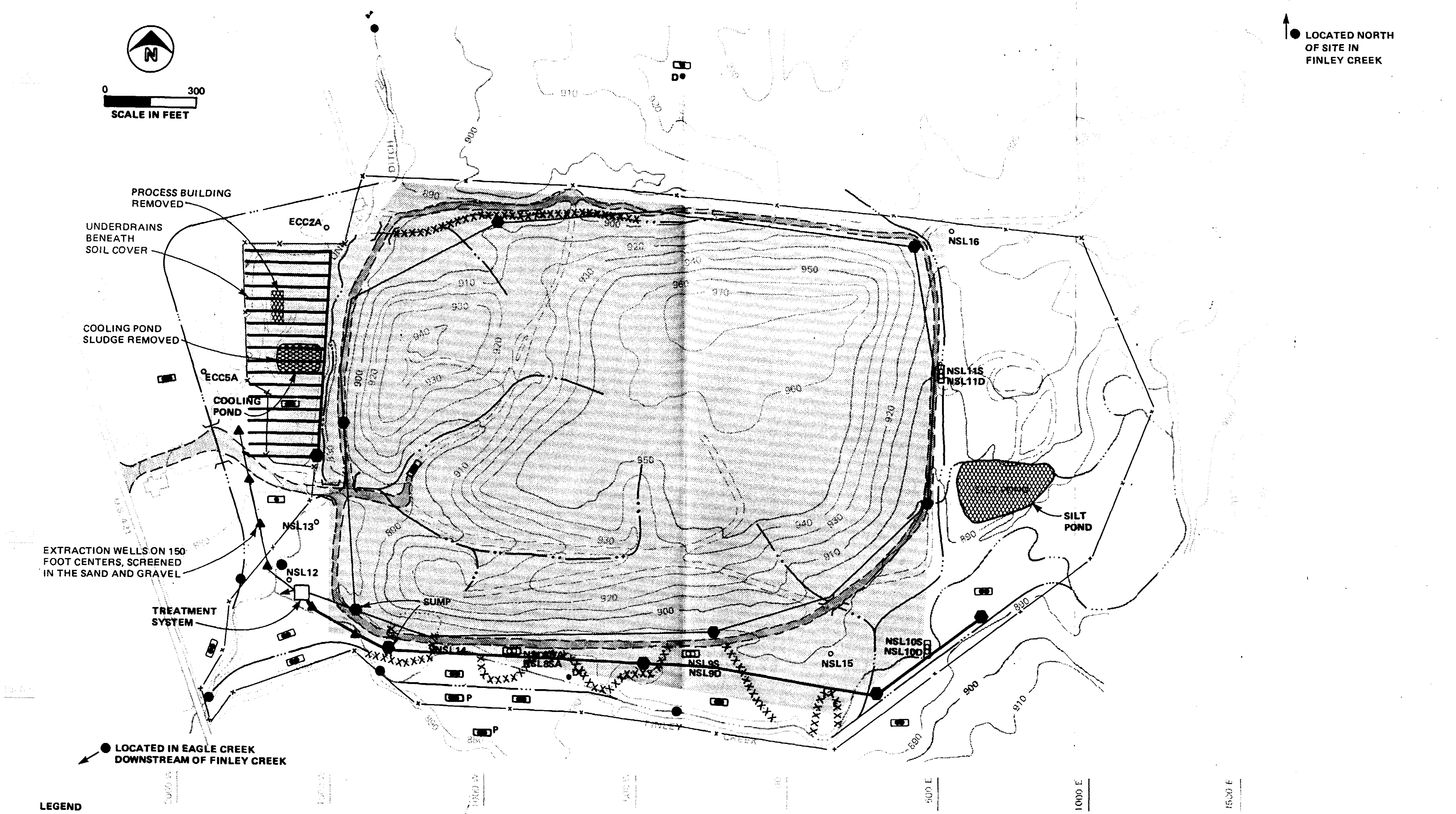
Monitoring

Monitoring of leachate and surface water and sediment would be as described for Alternative 2. Groundwater monitoring would also be similar for the first year. Following this, however, only 14 monitoring wells outside the perimeter of the groundwater collection system would be sampled on a semi-annual basis. The presence of the groundwater collection system allows the groundwater monitoring program to be less extensive. Water levels in monitoring wells and piezometers on either side of the collection system would be taken on a monthly basis.

Groundwater Interception

The groundwater collection system would consist of a French drain extending along the southern border of the landfill. The drain along Finley Creek would have an impermeable barrier along the south wall of the trench to minimize inflow of water from the creek. In the sand and gravel in the southwestern portion of the site, six extraction wells placed on 150-foot centers would be installed instead of a French drain. It is anticipated that an approximate 5-foot overall drawdown of the water table at the collection system would be sufficient to prevent groundwater movement past the system. Details of the collection system design are similar to those incorporated into NSL Alternatives 4 and 5 and are discussed in the NSL FS Report, Appendix B.

At the ECC site, a system of underdrains 40 feet apart would be constructed in the silty clay saturated zone (see Figure 2-4). The objective of the ECC underdrains is to collect the more heavily contaminated groundwater onsite in the till and to prevent it from migrating through the sand and gravel zone to the extraction wells south of the site. The 40-foot drain spacing was estimated on the basis of maintaining the existing upward vertical gradient from the sand and gravel deposit to



LEGEND

REROUTED CREEK	NEW PIEZOMETER NEST (P)	MANHOLE	NEW FENCE
EXISTING MONITORING WELL NEST (NSL10S, NSL10D)	NEW DEEP WELL (D)	NEW DITCHES	NEW LEACHATE COLLECTION SYSTEM
EXISTING MONITORING WELL (NSL15)	SURFACE WATER/SEDIMENT SAMPLING LOCATION	CULVERT	XXXXXXX SEDIMENT REMOVAL
NEW MONITORING WELL NEST	GROUNDWATER INTERCEPTION SYSTEM (CONSISTS OF FRENCH DRAINS UNLESS OTHERWISE NOTED)	ROAD IMPROVEMENTS	AREA OF SOIL COVER
		EXTRACTION WELL	

FIGURE 2-4
ALTERNATIVE 4
ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT
ECC-NSL CAA

the till to prevent downward migration of contaminants into the lower sand and gravel. Without the underdrains, the sand and gravel deposit beneath and south of the ECC site would be expected to become more heavily contaminated. Although this zone would eventually be purged of contaminants, it is considered more reliable and effective to minimize the migration of the groundwater contaminants. The ECC FS Report, Chapter 6 and Appendix B, presents additional detail on the design of the collection system.

Leachate and groundwater would be combined at the onsite treatment facility. Estimates of flowrates from each of the collection system components were generated using the available information on subsurface soil and groundwater conditions, and using the target drawdown of 5 feet along the collection system. The ECC underdrain would contribute an estimated 8 gpm, the French drain around NSL would contribute 25 gpm, and the six extraction wells would contribute 65 gpm. The leachate collection system would contribute 40 gpm. The estimated treatment flowrate is about 140 gpm.

The treatment system would be the similar to the one described for leachate in Alternative 2. Additional contaminants and flow would be expected from the groundwater collection system. To estimate average groundwater concentrations to be treated, projected concentrations of selected indicator contaminants found at the ECC site were combined with existing contaminant concentrations found at NSL. These are presented in Table 2-4 along with the leachate contaminant concentrations presented earlier for Alternative 2 and the applicable water quality criteria. As with Alternative 2, meeting the underlined criteria would result in also meeting drinking water criteria applied to Eagle Creek Reservoir.

Operation and Maintenance

Maintenance for Alternative 4 would be similar to Alternative 2. Some additional maintenance would be necessary to inspect and repair the French drains and periodically to redevelop collection wells and replace well pumps.

ALTERNATIVE 5--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT

The major components of Alternative 5 are:

- Access restrictions
- Cooling pond sludge removal
- RCRA cap and surface controls
- Monitoring
- Leachate collection
- Groundwater interception
- Treatment

Table 2-4
WATER QUALITY CRITERIA APPLICABLE TO LEACHATE AND GROUNDWATER DISCHARGE OF ALTERNATIVE 4

	Average Leachate Concentration (ug/l)	Average Groundwater[h] Concentration (ug/l)	Applicable Criteria (ug/l)				Drinking Water Act MCL's[f]	AWQC Drinking Water[g]
			One-Tenth 96 hr LC[d]	Protection of Aquatic Life[e] Acute	Protection of Aquatic Life[e] Chronic	Consumption of Aquatic Organisms[e]		
1,1,1-Trichloroethane	1	2,300	5,280	18,000	-	1,030,000[a]	200	19,000[a]
1,1,2-Trichloroethane	-	1.5	9,400	18,000	9,400	41.8[b]	-	0.6[b]
Chloroform	-	11	-	28,900	1,240	15.7[b]	100	0.19[b]
Benzene	106	104[i]	2,440	5,300	-	40[b]	5	0.67[b]
Ethylbenzene	101	350	4,230	32,000	-	3,280[a]	-	2,400[a]
Methylene Chloride	1,250	5,900	19,300	193,000	-	15.7[b]	-	0.19[b]
1,1-Dichloroethene	3	3[i]	-	30,300[a]	-	1.85[b]	7	0.033[b]
Trichloroethene	1	5,800	4,020	45,000	-	80.7[b]	5	2.8[b]
Tetrachloroethene	-	230	1,840	5,280	840	8.85[b]	10	0.8[b]
Toluene	26	1,800	3,400	17,500	-	-	-	15,000[b]
Phenol	149	4,400	570	10,200	2,560	769,000[a]	-	3,500[a]
4-Chloro-3-Methyl Phenol	62	-[i]	1.0	30	-	-	-	3,000[a]
Bis(2-Ethyl Hexyl)Phthalate	181	11	-	11,100	3	50,000	-	21,000[a]
DI-n-butyl Phthalate	12	9	-	940	-	154,000[a]	-	44,000[b]
Diethyl Phthalate	33	7	-	52,100	-	1,800,000[a]	-	434,000[a]
Dimethyl Phthalate	-	7	-	33,000	-	2,900,000[a]	-	350,000[a]
Napthalene	20	28[i]	15,000	23,000	620	0.0311[b]	-	-
Phenanthrene	20	5[i]	-	-	-	0.0311[b]	-	0.0028[b]
Arsenic	6	25	-	360	190	0.0175	50	0.0025[b]
Chromium (+6)	18	5	-	16	11	3,433,000	50	50[a]
Copper	33	4	-	42[c]	26[c]	-	1,000	1,000[a]
Cyanide	-	15	-	22	5.2	-	-	200[a]
Iron	32,600	2,550	-	-	1,000	-	300	-
Lead	45	22	-	264[c]	10[c]	-	50	50[a]
Nickel	76	71	-	3,700[c]	192[c]	100	-	15.4[a]
Zinc	123	31	-	687[c]	47[c]	-	5,000	5,000[a]

[a] Based on toxicity concentration.
[b] Based on carcinogenic protection.
[c] Contaminant concentration based on water hardness of 250 mg/l $CaCO_3$ equivalent.
[d] Based on published 96-hour median lethal concentration, (Verschueren, 1983).
[e] 1980 Federal Ambient Water Quality Criteria.
[f] Proposed maximum concentration level.
[g] 1980 Federal Ambient Water Quality Criteria.
[h] Average groundwater concentration includes projected groundwater concentrations of selected contaminants in till unit at ECC (see ECC RI Report, Chapter 5 (March 14, 1986) and existing groundwater concentrations at NSL perimeter (see NSL FS Report, Appendix A).
[i] Concentration not estimated for groundwater beneath ECC. Concentration represents NSL groundwater concentrations only.
___ Underline designates the lowest AWQ.

The site plan for Alternative 5 is shown in Figure 2-5.

The components for Alternative 5 are similar to Alternative 4 except that a RCRA cap is used instead of a soil cover. Also the French drain groundwater collection system in the fill at ECC is not included.

RCRA Cap

The RCRA cap was described under Alternative 3. The cap is estimated to reduce flow to the leachate collection system at NSL from 40 gpm to 5 gpm within 5 years.

Monitoring

Monitoring of leachate and surface water and sediment would be as described for Alternative 2. Groundwater monitoring would be similar to that described for Alternative 4.

Groundwater Interception

The groundwater interception system of this alternative has several differences from that described for Alternative 4 though the main objective of intercepting contaminated groundwater from the site remains the same. The interception system of Alternative 5 would be constructed so that it could function as a portion of a groundwater isolation system, if the isolation system becomes more advantageous in the future. The objective of groundwater isolation is to lower the water table below zones of soil contamination in the till unit. As a result, the isolation collection system of French drains would be installed at a lower elevation than the interception system. The isolation system is discussed further for Alternative 6.

The groundwater collection of Alternative 5 consists of a French drain installed along the southern and southwestern boundaries of the landfill and ECC to an estimated elevation of 865 (see Figure 2-5). The drain would include two collection pipes, one set 5 feet below the existing water table to function as the interception system, and the other set at the bottom of the trench to be used if the isolation system is implemented at a later time.

French drains replace extraction wells in the southwestern area of the site because a more expensive system of closely spaced wells would be required in an isolation system. The French drain, however, can be used for either system. The French drain would include an impermeable barrier on the south wall of the trench to minimize inflow of water from Finley Creek. The barrier would consist of an impermeable synthetic membrane and at least 6 inches of compacted clay. It would extend 3 feet into the till below the sand and gravel deposit in the southwest area of the site. The barrier would also extend 75 feet beyond the western end of the drain.

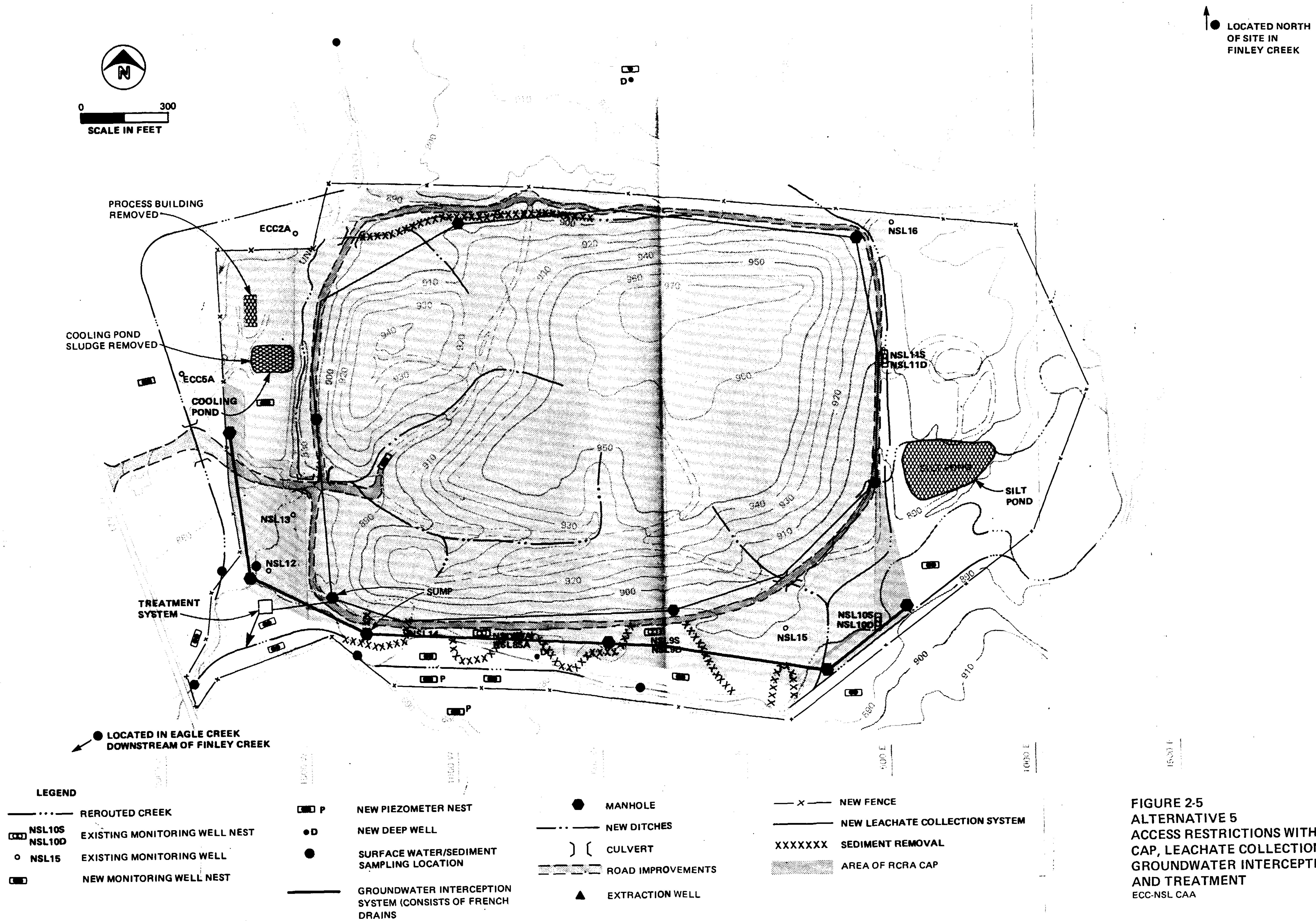


FIGURE 2-5
ALTERNATIVE 5
ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT
ECC-NSL CAA

The system of underdrains at ECC is not included in Alternative 5 since the RCRA cap would minimize the generation of heavily contaminated groundwater in the till. Although contaminated groundwater in the till could still migrate through the sand and gravel to the groundwater interception system, contaminant levels would likely be much lower than those produced without a RCRA cap.

The initial combined flowrate from the leachate and groundwater collection systems is estimated to be 100 gpm with 40 gpm from the leachate collection system. Within 5 years, the flow is estimated to decrease to about 65 gpm because of a reduction in leachate generation.

Operation and Maintenance

The groundwater collection system operation and maintenance requirements of Alternative 5 are less than Alternative 4 because extraction wells are not used. Treatment system operation and maintenance is less than Alternative 4 since the flowrate is lower. Operation and maintenance of the RCRA cap would be as described for Alternative 3.

ALTERNATIVE 6--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION, AND TREATMENT

The major components of Alternative 6 are:

- o Access restrictions
- o Cooling pond sludge removal
- o RCRA cap and surface controls
- o Monitoring
- o Leachate collection
- o Groundwater isolation
- o Treatment

The site plan for Alternative 6 is shown in Figure 2-6.

The components for Alternative 6 are similar to Alternative 5 except that groundwater isolation is used in place of groundwater interception. The French drain groundwater collection system in the till at ECC is included in Alternative 6.

Monitoring

Monitoring of leachate and surface water and sediment would be as described for Alternative 2. Groundwater monitoring would be similar to that described for Alternative 4 with the exception of increased monthly monitoring of the water level on either side of the groundwater isolation system.

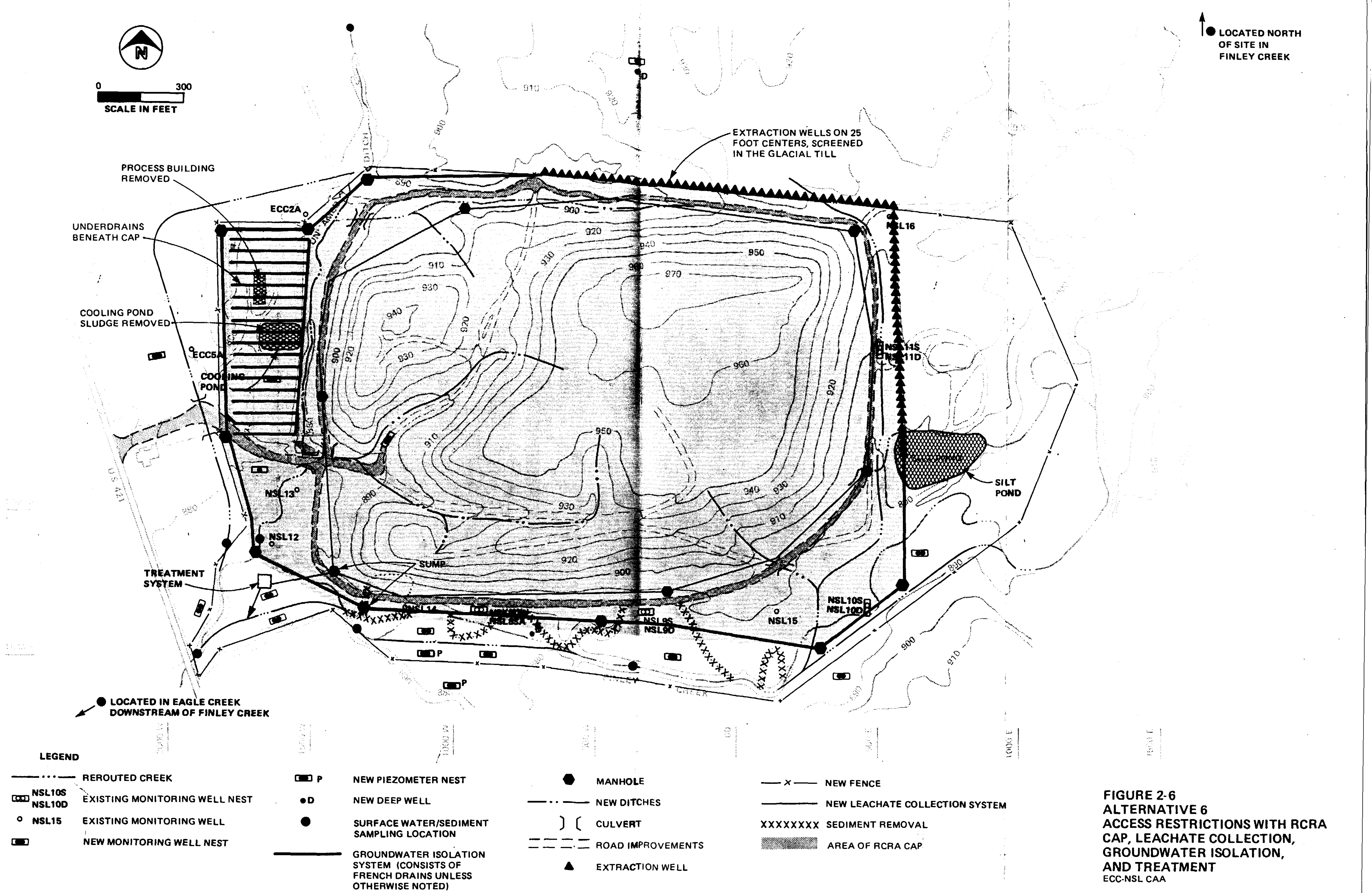


FIGURE 2-6
ALTERNATIVE 6
ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION, AND TREATMENT
ECC-NSL CAA

Groundwater Isolation

The objective of groundwater isolation is to lower the groundwater table below zones of soil contamination in the till unit. Together with the RCRA cap, this would minimize the transport of contaminants in the groundwater since the source of contaminants to the groundwater would be nearly eliminated. The collection system for groundwater isolation would be placed along the boundaries of the site to completely encircle both ECC and NSL. A French drain would be used throughout, except in the northeastern corner of the site. Extraction wells would be used in the northeast corner because installation of French drains at the depth required for the collection system (40 feet) would be difficult. Eighty-two wells on 25-foot centers were estimated to be required in this area. The estimated desired elevation of the water table is 865 feet. This elevation was chosen based on groundwater contamination observed in monitoring wells. The French drain along Finley Creek would have an impermeable barrier on the south wall of the trench to minimize inflow of water from the creek. Details of the groundwater isolation system are similar to those described for NSL Alternative 6 and are discussed in the NSL FS Report, Appendix B.

The underdrains at ECC are included in this alternative to prevent contaminated groundwater in the ECC till from migrating downward into the sand and gravel deposit under the initial strong downward gradients induced by the groundwater isolation system.

The underdrains at ECC would be similar in design to those of Alternative 4. The lower infiltration rate through the RCRA cap, however, would result in a water table near the bottom of the till. This would minimize any vertical downward gradient to prevent migration of the contaminated leachate to the sand and gravel deposit. The French drain to the south and west of the site would intercept the existing low level contamination in the sand and gravel deposit beneath and to the south of the ECC site.

Initially, the combined flowrate is estimated to be approximately 340 gpm with 40 gpm from the leachate collection system and 300 gpm from the groundwater collection system. Within 5 years, the flow is estimated to decrease to 200 gpm because of a reduction in leachate generation and lowering of the water table beneath the site to the desired elevation. Once the water table has reached the desired level, groundwater flow to the collection system will be primarily uncontaminated water from the site perimeter. It is anticipated that treatment will only be necessary for the leachate collected after this period (5 gpm).

Operation and Maintenance

The maintenance requirements of Alternative 6 will be very similar to Alternative 5. The additional wells and French drain required for the groundwater isolation will increase the maintenance somewhat; however, the operation and maintenance of the treatment system will decrease in the future, especially if only the leachate requires treatment.

ALTERNATIVE 7--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL VAPOR EXTRACTION

The major components of Alternative 7 are:

- Access restrictions
- Cooling pond sludge removal
- RCRA cap and surface controls
- Monitoring
- Leachate collection
- Groundwater isolation
- Treatment
- ECC soil vapor extraction

The site plan for Alternative 7 is shown in Figure 2-7. Alternative 7 contains all components of Alternative 6 and adds soil vapor extraction to remove volatile contaminants from soil.

ECC Soil Vapor Extraction

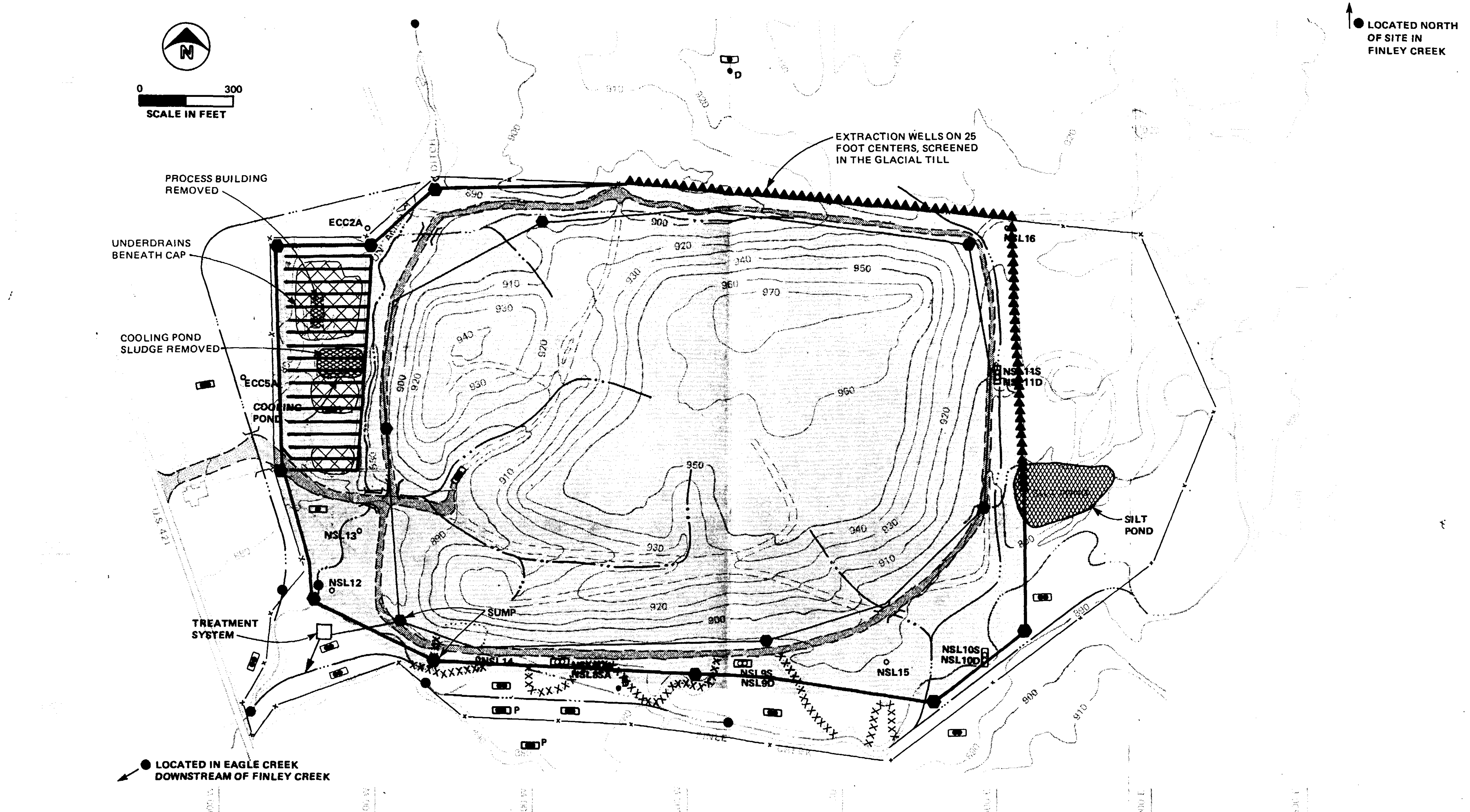
Vapor extraction (or enhanced volatilization) would reduce the level of contamination in the unsaturated zone by inducing a flow of air through the soil to evacuate the volatile contaminants. Volatile compounds in the air stream would then be adsorbed in a granular activated carbon adsorber system.

Vapor extraction wells would be screened in the unsaturated zone. A vacuum is placed on the well and air extracted from the well. As more air is extracted from the soil, the pressure around the well is lowered. The lower pressure has two effects:

- More contaminants are volatilized from the soil moisture into the soil gas.

- Air is drawn through the inlet wells and through the contaminated soil to the extraction well.

With the clean source of air, and a system of wells with overlapping effects, the contaminants can be extracted from the unsaturated zone.



LEGEND

	REROUTED CREEK	P	NEW PIEZOMETER NEST		MANHOLE		NEW FENCE
NSL10S NSL10D	EXISTING MONITORING WELL NEST	D	NEW DEEP WELL		NEW DITCHES		NEW LEACHATE COLLECTION SYSTEM
NSL15	EXISTING MONITORING WELL		SURFACE WATER/SEDIMENT SAMPLING LOCATION		CULVERT	XXXXXXXX	SEDIMENT REMOVAL
	NEW MONITORING WELL NEST		GROUNDWATER ISOLATION SYSTEM (CONSISTS OF FRENCH DRAINS UNLESS OTHERWISE NOTED)		ROAD IMPROVEMENTS		AREA OF RCRA CAP
					EXTRACTION WELL		SOIL VAPOR EXTRACTION SYSTEM

FIGURE 2-7
ALTERNATIVE 7
ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL VAPOR EXTRACTION
ECC-NSL CAA

Based on existing data, the system would consist of 10 networks of 8 air withdrawal (extraction) wells and 8 air inlet wells. They would be placed in areas that account for approximately 99.5 percent of the volatile contaminant mass in the unsaturated zone at ECC and include all areas where the volatile compound concentrations exceed the 1×10^{-6} excess lifetime cancer risk level from soil ingestion.

The extracted air would flow from the wells and into an air/water separator to remove any free water from the vapor stream. The air would flow from the air/water separator into a heater, where the temperature would be raised to 90°F, and then into the granular activated carbon adsorbers to remove the organic contaminants. Purified air would exit the carbon adsorbers through a vacuum pump and be discharged to the atmosphere.

The system described here is conceptual in nature. The exact number and placement of wells, withdrawal rate, and vacuum applied to each well will be based upon pilot testing before design. Additional soil sampling and analysis in the unsaturated zone would be performed to further delineate volatile distribution in the soil and aid in the optimal placing of wells.

Operation and Maintenance

Maintenance of Alternative 7 is similar to Alternative 6 except for the additional maintenance of the soil vapor extraction system.

The vapor extraction system would be monitored daily to assure that proper vacuums are being maintained. Additional routine maintenance of the pumps would be performed. In the pilot study stage and the initial stage of full-scale operations, daily sampling and analysis of the discharge air stream would be performed. In addition, at least three soil gas monitoring points would be installed at each network to allow monitoring of removal rates. Air samples would be analyzed by GC/MS. After the first week, monitoring could be reduced to weekly for the next 2 months and then biweekly to monthly for the duration of the operation. The initial samples would be analyzed for a complete volatile organic scan. Three or four key compounds can then be chosen and routine monitoring performed for them. Periodic complete volatile scans would be performed to monitor changes in discharge makeup.

Based on the monitoring of both the soil gas composition and the discharge stream, a system termination point can be chosen. It is estimated that the vapor extraction system may take 2 to 4 years to lower VOC concentrations below the 10^{-6} cancer risk level from soil ingestion.

ALTERNATIVE 8--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL INCINERATION

The major components of this alternative are:

- Access restrictions
- Cooling pond sludge removal
- RCRA cap and surface controls
- Monitoring
- Leachate collection
- Groundwater isolation
- Treatment
- ECC soil incineration

The site plan for Alternative 8 is shown in Figure 2-8. Alternative 8 contains all components of Alternative 6 and adds incineration of ECC-contaminated soil.

ECC Soil Incineration

Soil with organic contaminant concentrations above 1×10^{-6} excess lifetime cancer risk levels would be incinerated onsite.

It is assumed here that the incinerated soil could be managed as though it were not a hazardous waste and be disposed of onsite. A RCRA cap would be placed over the incinerated soil replaced on the site.

The main components of the incineration process are the rotary kiln, afterburner, packed tower, and wet scrubber. The incineration facility would take approximately 1 year to design and install, and an additional 1 to 3 years for startup and permitting. Incineration of 14,400 cubic yards of soil and 7,500 cubic yards of the existing silty-clay cap (assuming a 15 percent moisture content) would take from 1.5 to 4 years at a throughput of 1 to 2 cubic yards per hour for 300 days per year. Operating the kiln continuously would reduce thermal stress on the refractory, although some down time has been allowed. After the soil has been treated, the incinerator would be dismantled and salvaged or reused on other sites.

The rotary kiln would operate at 2,200°F with a total waste-heat input of 23 million Btu/hour. Residence time of a waste material is a function of temperature, rotational speed, and kiln angle to horizontal. A trial burn conducted at the startup time will determine these factors along with the residence time. In general, solid wastes can take several hours for combustion. Rotary kiln systems usually have a secondary combustion chamber, or afterburner, following the kiln to ensure complete combustion of the waste and gases from the kiln. This chamber is usually designed to have a gas residence time of a few seconds with temperatures between 2,200 and 3,000°F.

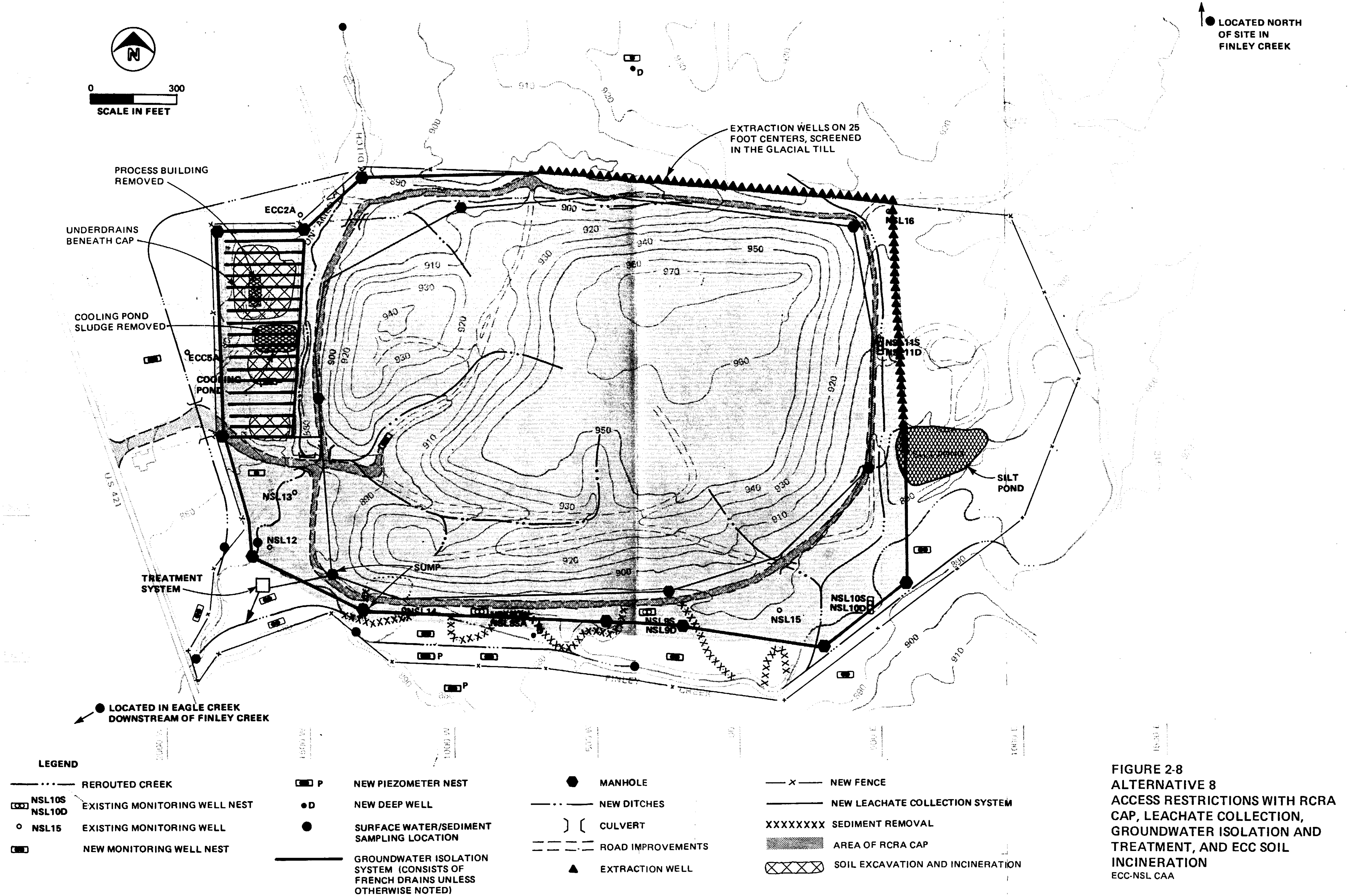


FIGURE 2-8
ALTERNATIVE 8
ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL INCINERATION
ECC-NSL CAA

To operate, the kiln would require approximately 225 gallons per hour of supplemental fuel oil because of the low heating value of the soil. Electrical requirements for the complete system would be 130 kW. Water requirements would vary depending on the kiln and scrubber design. At most, approximately 450 gpm would be needed if the system included a venturi scrubber.

The contaminated soil would be ram fed or conveyed through the higher end of the kiln. As the kiln rotates, the incinerated soil moves to the lower end of the kiln where it is discharged. The residual ash would then be replaced onsite.

High levels of nitrogen oxide emissions are expected, especially when a rotary kiln is operated at higher temperatures. Nitrous oxides are formed from thermal fixation of nitrogen in the air used for combustion or from organic nitrogen compounds present in the waste. Emissions of nitrogen oxide and particulate matter are dependent on the waste. Sulfur oxides are formed from sulfur present in the waste material and auxiliary fuel. A wet scrubber is assumed to be necessary for control of emissions of particulate matter and the gaseous products of combustion.

ALTERNATIVE 9--ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

The major components of this alternative are:

- o Access restrictions
- o Rerouting of surface waters
- o Monitoring
- o Construction of RCRA landfill
- o Excavation of contaminated soil, landfill contents, and sediment

This alternative involves the excavation of the landfill contents, contaminated soils around and under the landfill, and ECC-contaminated soils with subsequent placement in an onsite RCRA landfill. The landfill would be located in the northern portion of the Northside Landfill site as shown in Figure 2-9.

A RCRA-type landfill would include construction of the following: a double liner, leachate collection system, leachate and groundwater monitoring system, gas collection system, and multimedia cap. The general scheme of a RCRA-type landfill is shown in Figures 2-10 and 2-11. As of this writing, the northern portion of the site (which was used as a borrow pit) has been excavated down to elevation 900 to 920. This

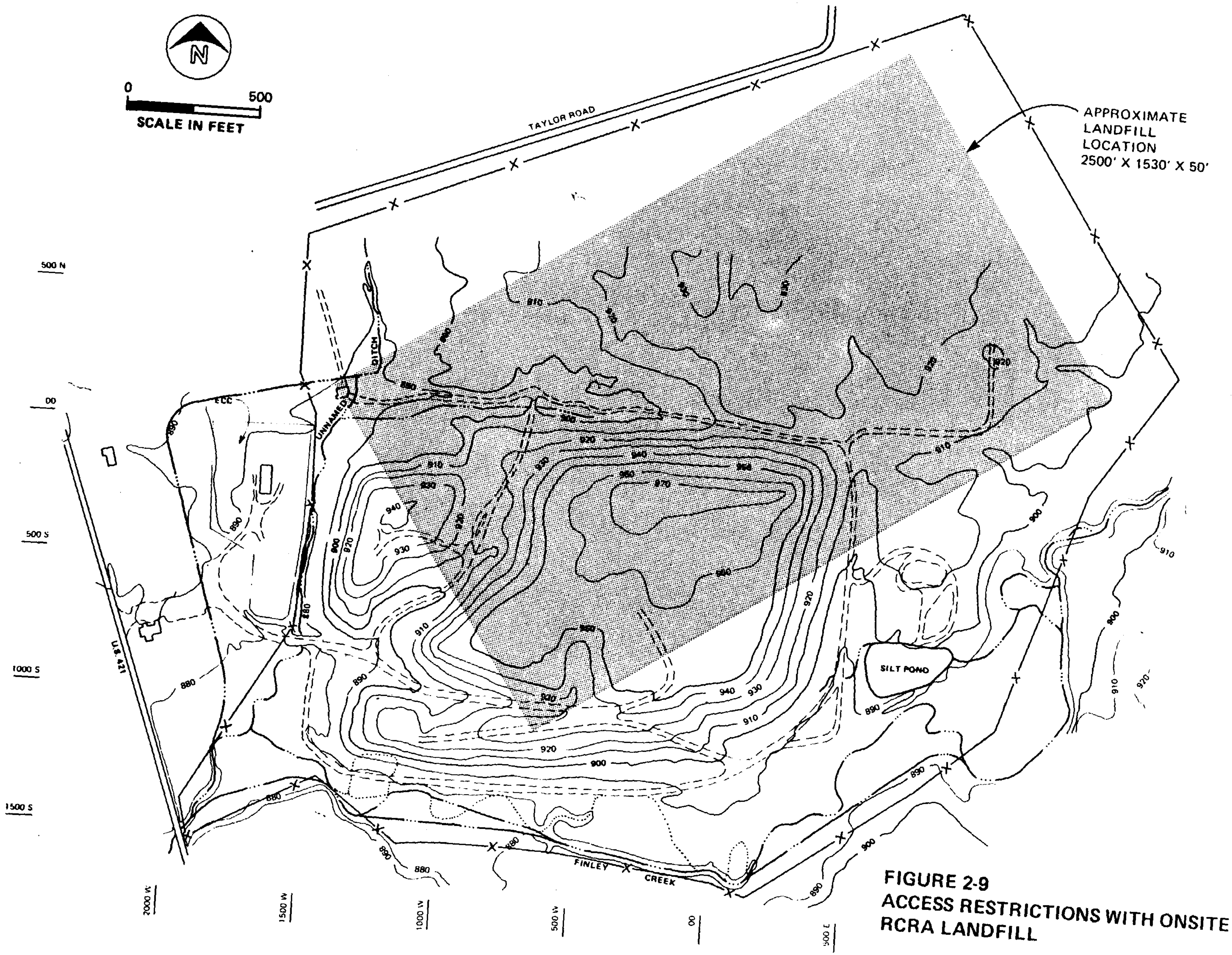


FIGURE 2-9
ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

ECC - NSL CAA

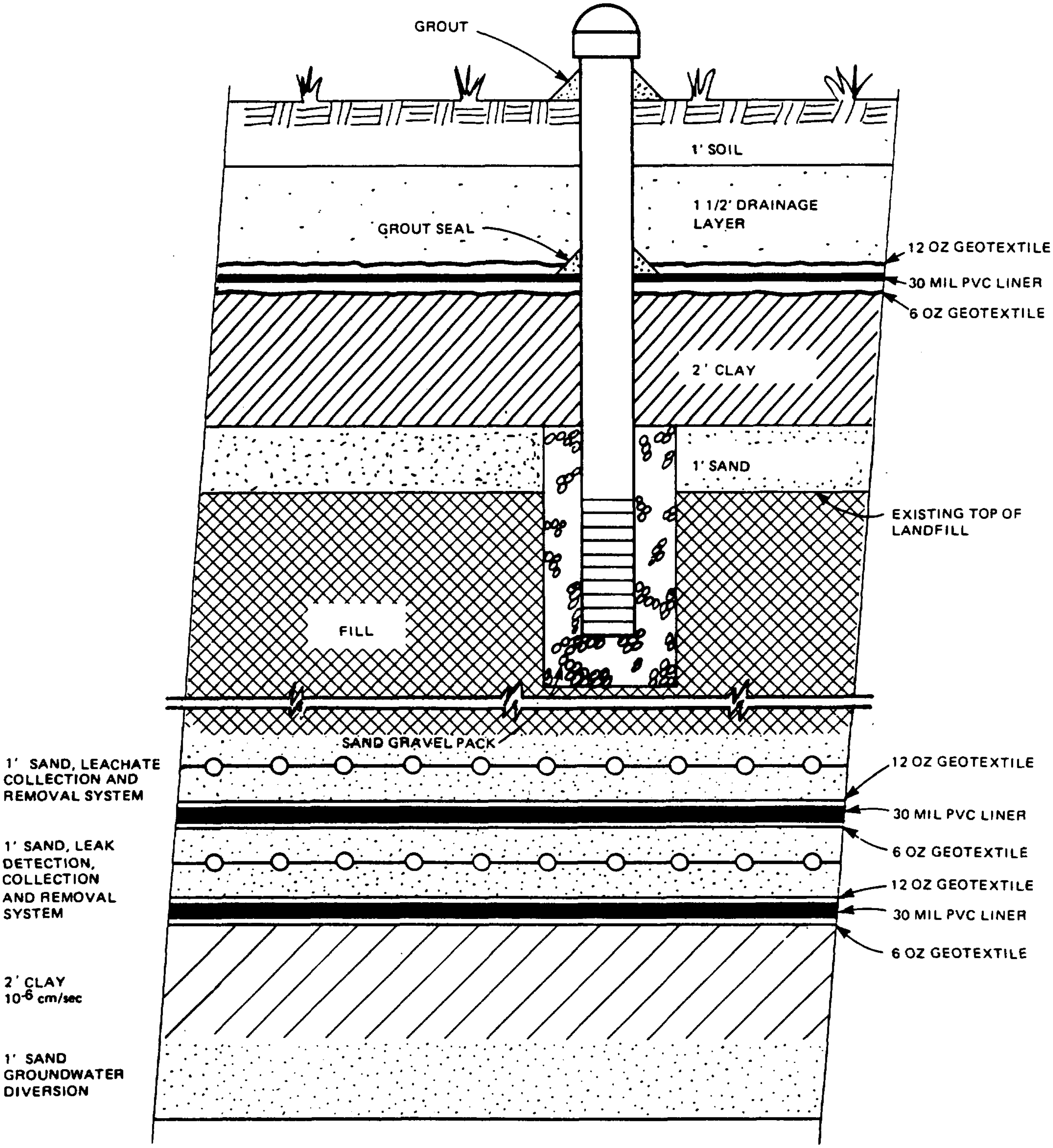


FIGURE 2-10
RCRA CAP AND GAS VENTING SYSTEM AND BOTTOM LINER
ECC-NSL CAA

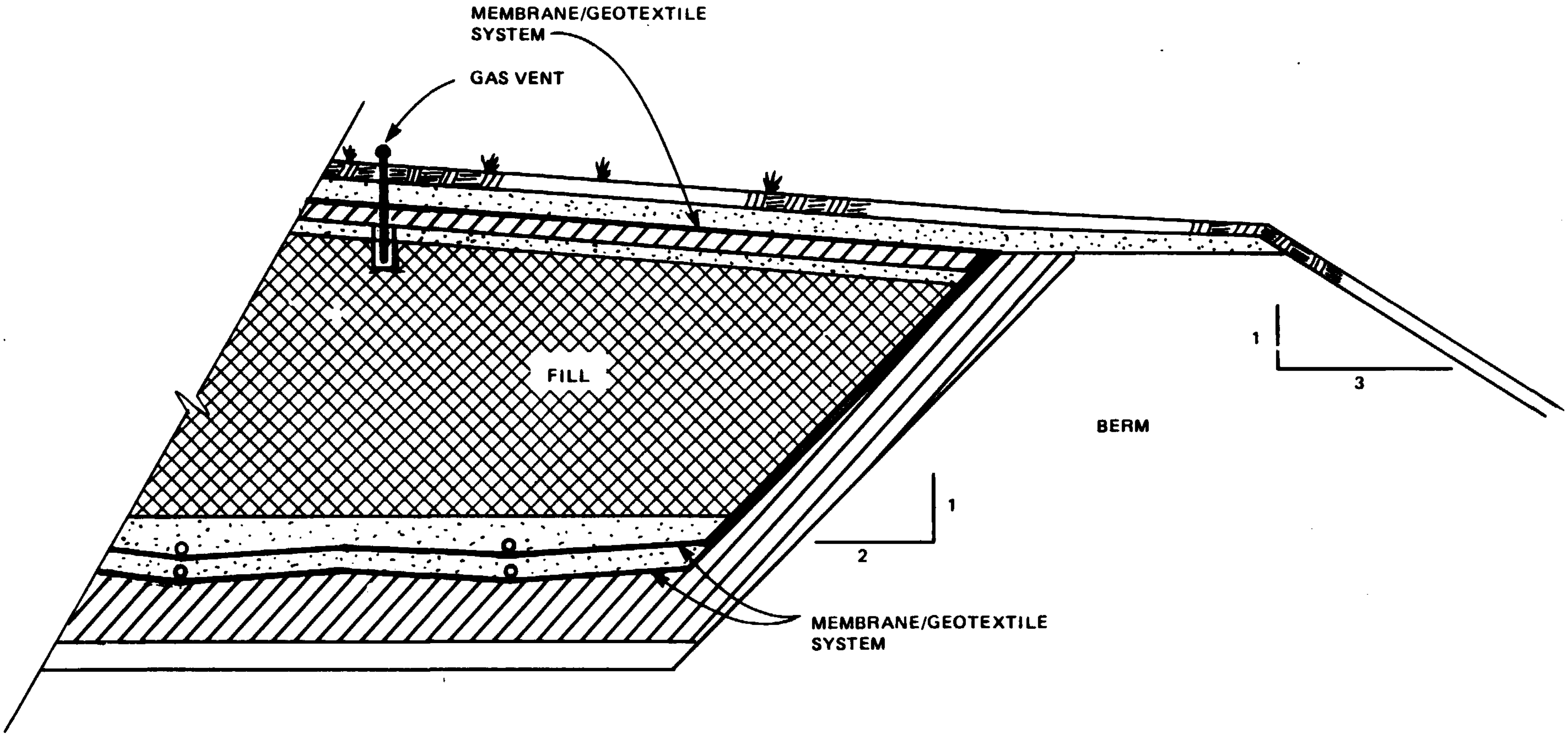


FIGURE 2-11
ONSITE RCRA LANDFILL
PARTIAL CROSS-SECTION
ECC-NSL CAA

part of the site could be an appropriate location for an onsite RCRA-type landfill.

Construction of the landfill would begin first followed by excavation of the existing landfill contents to prelandfilled ground surface. An additional 30 feet of soil in the saturated zone beneath the landfill on the southern half of the site was assumed to require excavation. ECC-contaminated soil was assumed to require excavation to elevation 865 feet or about 20 feet below ground surface. Excavation, placement, and construction would occur in a step-wise fashion to accommodate efficient work patterns. During excavation, the landfill contents would have to be sampled to determine their character. Highly contaminated wastes such as PCB's and reactive and low flashpoint substances cannot be stored in a RCRA landfill. They must be treated before disposal. Similarly, sludges and liquids may not be disposed of directly in a RCRA landfill, but must first be solidified or containerized. To establish a cost for this alternative, it was assumed that no treatment would be required for the materials to be placed in the RCRA landfill. Treatment of groundwater and dewatering liquids during construction of the RCRA landfill may be necessary but was not included in the cost of the alternative.

Operation and Maintenance

Operation and maintenance includes monitoring and repairs for the new landfill. The surface water and groundwater will be monitored to detect migration of residual contamination. Air quality will also be monitored. Maintenance will be required to maintain the integrity of the RCRA landfill. This will include erosion control; freeze-thaw repairs; mowing, grading, and reseeding the cap; and maintenance of access restrictions. Collection and disposal of leachate from the RCRA landfill should be minimal if the landfill is constructed correctly.

GLT655/9

Chapter 3
DETAILED ANALYSIS OF ALTERNATIVES

In accordance with Section 300.68(h) of the NCP, a detailed analysis of the alternatives, described in Chapter 2, is presented in this chapter. It includes technical, public health and welfare, environmental, institutional, and cost evaluations.

The detailed analysis presented is not intended to be all inclusive and encompassing, but it is intended to present sufficient information concerning each alternative to allow for a comparative evaluation. Additional information and considerations should be addressed during the detailed design of the selected alternative to better refine the implementation of the alternative. Numerous details will require additional evaluation and incorporation into the design if adequate safeguards are to be provided to allow for proper system performance and reliability.

TECHNICAL EVALUATION OF ALTERNATIVES

This section presents an evaluation of the technical aspects for each alternative. The technical evaluation involves assessing the ability, and generally to what degree, each alternative satisfies a given set of technical evaluation criteria.

TECHNICAL EVALUATION CRITERIA

Technical evaluation criteria described below were developed based on the EPA Feasibility Study Guidance document and reflect the NCP requirements for evaluation of engineering implementation, reliability, and constructibility.

- Performance
    - Effectiveness to meet the remedial action goals
    - Useful life of components
- Reliability
    - Demonstrated performance considering potential for poor performance or failure of system components and operational flexibility to address variations between design criteria and actual field conditions
    - Operation and maintenance requirements considering operation complexity, reliance on

monitoring results for reliable operation, and maintenance requirements and frequency

- Implementability
  - Ease of installation and time of implementation
  - Time required to achieve the remedial action goals
- Safety
  - Risk to public health and the environment in the event of system failure
  - Safety aspects during construction

TECHNICAL EVALUATION

The following discussion summarizes the more pertinent technical aspects of the alternatives. Table 3-1 presents a detailed listing of the technical evaluation criteria and the associated technical assessment for each alternative.

Elements Common To All Alternatives

Several elements are common to all the remedial action alternatives (with the exception of No Action). These primarily relate to the reliability of access restrictions in preventing exposure to onsite soil or onsite groundwater contamination. Since the contaminant source characteristics are largely unknown, the time period for the site contaminants to either be naturally degraded or removed through a groundwater collection system cannot be reliably estimated. As discussed in Chapter 1, it is possible, especially with the potential for buried drums onsite, that this period may well exceed 100 years. The reliability of deed restrictions in preventing future site development or use of groundwater beneath the site over this time period is not known.

Performance

All alternatives except No Action address the remedial action objectives relating to contaminated soil, leachate, and groundwater. Given proper implementation, operation, and maintenance of the alternatives, Alternatives 2 through 9 would be effective in reducing risks to public health and the environment from exposure via pathways associated with these media provided groundwater contaminant types and levels do not increase in the future. If levels or contaminant types do increase, Alternatives 2 and 3 would not be effective in reducing risks to the public health or environment since no groundwater controls are undertaken. Alternative 3, however, reduces

TECHNICAL EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Access Restrictions With Soil Cover, Leachate Collection and Treatment	ALTERNATIVE 3 Access Restrictions With RCRA Cap, Leachate Collection and Treatment	ALTERNATIVE 4 Access Restrictions With Soil Cover, Leachate Collection, Groundwater Interception and Treatment	ALTERNATIVE 5 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Interception and Treatment
Performance					
Effectiveness in Meeting Goals					
Protection of public and environment from direct contact, inhalation, and ingestion of contaminants in NSL landfill contents, surface or subsurface soil on ECC and NSL, NSL leachate sediment, and sediment in the old creek beds of Finley Creek.	Potential exists for adverse health effects resulting from exposure to subsurface soil in landfill contents and leachate sediments and sediments in the old creek beds of Finley Creek. Soil cover at ECC may pose low level public health risk.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of soil cover for an indefinite period.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of soil cover for an indefinite period.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period.
Protection of public health and environment from direct contact, inhalation, and ingestion of contaminated leachate or its migration to surface waters and sediments at levels posing risks.	Potential exists for adverse effects to public health and environment from future releases of contaminants in leachate.	Effective in protecting public health from direct contact with contaminants by eliminating surface leachate discharge. Leachate collection and soil cover eliminates discharges to surface water. Leachate can still migrate to groundwater.	Effective in protecting public health from direct contact with contaminants by eliminating surface leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent.	Effective in protecting public health from direct contact with contaminants by eliminating surface leachate discharge. Leachate collection and soil cover eliminates discharges to surface water. Leachate can still migrate to groundwater. Groundwater is subsequently collected and treated.	Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collections and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated.
Protection of public health and the environment from direct consumption of contaminated groundwater or its migration to surface waters at levels posing risks.	Potential exists for adverse health effects from consumption of contaminated groundwater or fish that have bioconcentrated contaminants. Potential exists for adverse effects on public health and environment from future releases of contaminants to surface water.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Migration of contaminants to surface water is not eliminated. Groundwater and surface water monitoring should allow detection of contaminants posing risks. However, sufficient time to implement migration action may not be available before health or environment are affected.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Migration of contaminants to surface water is not eliminated, although would be reduced relative to Alternative 2. Groundwater and surface water monitoring should allow detection of contaminants posing risks. However, sufficient time to implement mitigative action may not be available before health or environment are affected.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Effective in preventing migration of contaminated groundwater to surface water or offsite.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Effective in preventing migration of contaminated groundwater to surface water or offsite.
Useful Life of Components		With proper maintenance soil cover does not have a limit on useful life. Useful life of treatment facility is estimated at 30 years. Replacement required.	Useful life of RCRA cap is estimated at 30 years. Replacement is required. Useful life of treatment facility is estimated at 30 years. Replacement required.	With proper maintenance soil cover does not have a limit on useful life. Useful life of treatment facility is estimated at 30 years. Replacement required. Useful life of groundwater collection system is estimated at 50 years.	Useful life of RCRA cap is estimated at 30 years. Replacement is required. Useful life of treatment facility is estimated at 30 years. Replacement required. Useful life of groundwater collection system is estimated at 50 years.
Reliability					
Demonstrated Performance					
Potential for poor performance or failure of system or components (assuming design assumptions are representative of actual site conditions).		Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Leachate collection with French drains is proven technology and is reliable. Treatment processes are well demonstrated and reliable. Long-term reliability may diminish if system must be upgraded and maintained long past 30 years.	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Long-term reliability of RCRA cap has not been demonstrated through is believed to be good given proper maintenance. Leachate collection with French drains is proven technology and is reliable.	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Leachate and groundwater collection with French drains is a proven technology and is reliable. Groundwater collection with extraction wells is proven technology and is reliable. Treatment processes are well demonstrated and reliable. Long-term reliability may diminish if system must be upgraded and maintained long past 30 years.	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Long-term reliability of RCRA cap has not been demonstrated though is believed to be good given proper maintenance. Leachate and groundwater collection with French drains is a proven technology and is reliable. Treatment processes are well demonstrated and reliable. Long-term reliability may diminish if system must be upgraded and maintained long past 30 years.
Demonstrated Performance (Continued)					
Operational flexibility to address variations between design assumptions and actual site conditions.		Remediation of offsite groundwater or surface water contamination once it has been detected may require 1 year or more for implementation. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	Remediation of offsite groundwater or surface water contamination once it has been detected may require 1 year or more for implementation. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	Extraction wells may be pumped at varying rates to provide flexibility. French drains are passive and have some flexibility but little control. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	French drains are passive and have some flexibility but little control. French drain groundwater interception system could be easily converted to isolation system if contaminant levels increase significantly in the future and long-term (>100 years) operation of collection system appears necessary. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.
Operation and Maintenance Requirements					
Operational Complexity		Operation is relatively simple and is not expected to effect the alternatives reliability.	Operation is relatively simple and is not expected to effect the alternatives reliability.	Operation of groundwater interception system introduces some complexity, although it is not expected to substantially effect system reliability.	Operation of groundwater interception system introduces some complexity, although it is not expected to substantially effect system reliability.
Reliance on Monitoring		Monitoring frequency and comprehensiveness are critical to successful implementation.	Monitoring frequency and comprehensiveness are critical to successful implementation.	Monitoring results are important to reliable operation of groundwater interception system.	Monitoring results are important to reliable operation of groundwater interception system.
Maintenance Requirements and Frequency			Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap.		Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap.

TABLE 3-1 (Sheet 1 of 4)
TECHNICAL EVALUATION OF ALTERNATIVES
ECC-NSL CAA

TECHNICAL EVALUATION CRITERIA	ALTERNATIVE 6 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment	ALTERNATIVE 7 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Vapor Extraction	ALTERNATIVE 8 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration	ALTERNATIVE 9 Access Restrictions With Onsite RCRA Landfill
Performance				
Effectiveness in Meeting Goals				
Protection of public and environment from direct contact, inhalation, and ingestion of contaminants in NSL landfill contents, surface or subsurface soil on ECC and NSL, NSL leachate sediment, and sediment in the old creek beds of Finley Creek.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Public health risk from future site excavation and direct contact, inhalation, and ingestion of VOC's in ECC contaminated soil is reduced to below 10^{-6} cancer risk levels. ADI exceedance unchanged for lead and cadmium.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Public health risk from future site excavation and direct contact, inhalation, and ingestion of organic contaminants in soil reduced to below 10^{-6} cancer risk levels. ADI exceedance unchanged for lead and cadmium.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period.
Protection of public health and environment from direct contact, inhalation, and ingestion of contaminated leachate or its migration to surface waters and sediments at levels posing risks.	Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collections and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated.	Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. ECC soil vapor extraction greatly reduces generation of contaminated leachate.	Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. ECC soil incineration greatly reduces generation of contaminated leachate at ECC.	Effective in protecting public health from direct contact with contaminants by eliminating surface leachate discharge. If properly constructed, the onsite RCRA landfill would prevent leachate discharges.
Protection of public health and the environment from direct consumption of contaminated groundwater or its migration to surface waters at levels posing risks.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite.	Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite.
Useful Life of Components	Useful life of RCRA cap is estimated at 30 years. Replacement is required. Useful life of treatment facility is estimated at 30 years. Useful life of groundwater collection system is estimated at 50 years. Replacement required.	Useful life of RCRA cap is estimated at 30 years. Replacement is required. Useful life of treatment facility is estimated at 30 years. Replacement required. Useful life of groundwater collection system is estimated at 50 years.	Useful life of RCRA cap is estimated at 30 years. Replacement is required. Useful life of treatment facility is estimated at 30 years. Useful life of groundwater collection system is estimated at 50 years.	Useful life of RCRA cap is estimated at 30 years. Replacement is required.
Reliability				
Demonstrated Performance				
Potential for poor performance or failure of system or components (assuming **design assumptions are representative of actual site conditions**).	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Long-term reliability of RCRA cap has not been demonstrated though is believed to be good given proper maintenance. Leachate and groundwater collection with French drains is a proven technology and is reliable. Groundwater collection with extraction wells is proven technology and is reliable. Releases from leaking drums or immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Treatment processes are well demonstrated and reliable. Long-term reliability may diminish if system must be upgraded and maintained long past 30 years.	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Long-term reliability of RCRA cap has not been demonstrated though is believed to be good given proper maintenance. Leachate and groundwater collection with French drains is a proven technology and is reliable. Groundwater collection with extraction wells is proven technology and is reliable. Releases from leaking drums or immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Treatment processes are well demonstrated and reliable. Long-term reliability may diminish if system must be upgraded and maintained long past 30 years. Soil vapor extraction has proven reliable under different site conditions. Pilot testing would be necessary.	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Long-term reliability of RCRA cap has not been demonstrated though is believed to be good given proper maintenance. Leachate and groundwater collection with French drains is a proven technology and is reliable. Groundwater collection with extraction wells is proven technology and is reliable. Releases from leaking drums or immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Treatment processes are well demonstrated and reliable. Long-term reliability may diminish if system must be upgraded and maintained long past 30 years. Soil incineration has been demonstrated to be reliable in destroying organic contaminants.	Deed restrictions require maintenance for an indefinite time period. Potential exists that deed restrictions may not continue into the future. Long-term reliability of RCRA landfills has not been demonstrated though is believed to be good given proper maintenance.
Demonstrated Performance (Continued)				
Operational flexibility to address variations between design assumptions and actual site conditions.	Extraction wells may be pumped at varying rates to provide flexibility. French drains are passive and have some flexibility but little control. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	Extraction wells may be pumped at varying rates to provide flexibility. French drains are passive and have some flexibility but little control. Treatment system has a high degree of flexibility to treat varying contaminant levels or types. Vapor extraction rates and number of wells can be easily altered to address variations between design assumptions and field conditions.	Extraction wells may be pumped at varying rates to provide flexibility. French drains are passive and have some flexibility but little control. Treatment system has a high degree of flexibility to treat varying contaminant levels or types. Incineration has good flexibility to changes in contaminant types or level. Feed rates and incineration temperatures can be varied to match needed conditions.	The design of a RCRA landfill provides flexibility.

TABLE 3-1 (Sheet 2 of 4)
TECHNICAL EVALUATION OF ALTERNATIVES
ECC - NSL CAA

TECHNICAL EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Access Restrictions With Soil Cover, Leachate Collection and Treatment	ALTERNATIVE 3 Access Restrictions With RCRA Cap, Leachate Collection and Treatment	ALTERNATIVE 4 Access Restrictions With Soil Cover, Leachate Collection, Groundwater Interception and Treatment	ALTERNATIVE 5 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Interception and Treatment
Reliability (continued)					
Demonstrated Performance (Continued)					
Operational flexibility to address variations between design assumptions and actual site conditions.		Remediation of offsite groundwater or surface water contamination once it has been detected may require 1 year or more for implementation. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	Remediation of offsite groundwater or surface water contamination once it has been detected may require 1 year or more for implementation. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	Extraction wells may be pumped at varying rates to provide flexibility. French drains are passive and have some flexibility but little control. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.	French drains are passive and have some flexibility but little control. French drain groundwater interception system could be easily converted to isolation system if contaminant levels increase significantly in the future and long-term (>100 years) operation of collection system appears necessary. Treatment system has a high degree of flexibility to treat varying contaminant levels or types.
Operation and Maintenance Requirements					
Operational Complexity		Operation is relatively simple and is not expected to effect the alternatives reliability.	Operation is relatively simple and is not expected to effect the alternatives reliability.	Operation of groundwater interception system introduces some complexity, although it is not expected to substantially effect system reliability.	Operation of groundwater interception system introduces some complexity, although it is not expected to substantially effect system reliability.
Reliance on Monitoring		Monitoring frequency and comprehensiveness are critical to successful implementation.	Monitoring frequency and comprehensiveness are critical to successful implementation.	Monitoring results are important to reliable operation of groundwater interception system.	Monitoring results are important to reliable operation of groundwater interception system.
Maintenance Requirements and Frequency			Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap.		Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap.
Implementability					
Ease of Installation and Time to Implement		Installation of soil cover is extensive but relatively simple.	Implementation of RCRA cap requires careful installation of each media, especially the impermeable membrane.	Installation of soil cover is extensive but relatively simple.	Implementation of RCRA cap requires careful installation of each media, especially the impermeable membrane.
Time to Achieve Remedial Action Goals		Estimated time of design and construction is 6 months to 1 year.	Estimated time of design and construction is 1 to 2 years.	Estimated time of design and construction is 1 year.	Estimated time of design and construction is 1 to 2 years. Estimated 5 years to achieve lowering of water table beneath site.
Safety					
Risk to public health and environment in the event of system failure.		The failure of the monitoring program to detect groundwater or surface water contamination could result in adverse health effects on the public and adverse effects on the aquatic life. If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels.	The failure of the monitoring program to detect groundwater or surface water contamination could result in adverse health effects on the public and adverse effects on the aquatic life. If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of cap would increase reliance on monitoring for protection of public health and environment. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels.	If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of groundwater interception system would likely be detected before significant risk to public health or environment occurs. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels. Treatment systems has 2-day holding capacity for leachate in event of failure. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered.	If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of groundwater interception system would likely be detected before significant risk to public health or environment occurs. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels. Treatment system has 2-day holding capacity for leachate in event of failure. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered.
Safety During Construction		Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system and soil cover.	Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system and cap.	Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system, soil cover and groundwater collection system.	Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system, cap, and groundwater collection system.

TABLE 3-1 (Sheet 3 of 4)
TECHNICAL EVALUATION OF ALTERNATIVES
ECC-NSL CAA

TECHNICAL EVALUATION CRITERIA	ALTERNATIVE 6 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment	ALTERNATIVE 7 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Vapor Extraction	ALTERNATIVE 8 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration	ALTERNATIVE 9 Access Restrictions With Onsite RCRA Landfill
Reliability (continued)				
Operation and Maintenance Requirements				
Operational Complexity	Groundwater isolation system is operationally more complex than groundwater interception and system reliability to perform as designed is less.	Groundwater isolation system is operationally more complex than groundwater interception and system reliability to perform as designed is less.	Groundwater isolation system is operationally more complex than groundwater interception and system reliability to perform as designed is less.	Operation is relatively simple and is not expected to effect the alternative's reliability.
Reliance on Monitoring	Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained.	Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained.	Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained.	Monitoring is essential to check the integrity of the landfill liner.
Maintenance Requirements and Frequency	Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap.	Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap.	Maintenance requirements of cap are substantial because of potential landfill settlement. This reduces the reliability of the cap. Operation of soil incinerator is complex and would require full-time trained operator. Partial replacement of refractory is common maintenance requirement.	Maintenance requirements of RCRA landfill are substantial because of potential for settlement. This reduces the reliability of the cap and liner.
Implementability				
Ease of Installation and Time to Implement	Implementation of RCRA cap requires careful installation of each media, especially the impermeable membrane.	Implementation of RCRA cap requires careful installation of each media, especially the impermeable membrane.	Implementation of RCRA cap requires careful installation of each media, especially the impermeable membrane.	Implementation of RCRA landfill is extensive and requires careful installation of the cap and liner.
Time to Achieve Remedial Action Goals	Estimated time of design and construction is 1 to 2 years. Estimated 5 years to achieve lowering of water table beneath site.	Installation of cap over ECC would follow the 2 to 4 year operation period of soil vapor extraction. Total estimated time of design and construction is 3 to 6 years. Estimated 5 years to achieve lowering of water table beneath site.	Installation of cap over ECC would follow the 3 to 4 years implementation period of ECC soil incineration. Total estimated time of design and construction is 4 to 6 years. Estimated 5 years to achieve lowering of water table beneath site.	Estimated time of design and construction is 3 to 5 years.
Safety				
Risk to public health and environment in the event of system failure.	If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of groundwater collection system would likely be detected before significant risk to public health or environment occurs. Groundwater isolation system provides additional time for remediation after failure detection. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels. Treatment system has 2-day holding capacity for leachate in event of failure. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered.	If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of groundwater collection system would likely be detected before significant risk to public health or environment occurs. Groundwater isolation system provides additional time for remediation after failure detection. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels. Treatment system has 2-day holding capacity for leachate in event of failure. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered.	If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment. Failure of groundwater collection system would likely be detected before significant risk to public health or environment occurs. Groundwater isolation system provides additional time for remediation after failure detection. Failure of treatment system not likely to pose risk to public health or the environment over the short-term at present contaminant levels. Treatment system has 2-day holding capacity for leachate in event of failure. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered.	Failure of RCRA landfill would lead to release of contaminants and may effect public health and the environment. Remediation after detection of failure could likely be implemented before significant risk to public health or the environment occurred. If access restrictions are not maintained in the future, site excavation or development could result in substantial risks to public health and the environment.
Safety During Construction	Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system, cap, and groundwater collection system.	Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system, cap, and groundwater collection system. Air emissions during soil vapor extraction system are not believed to pose risk to operator.	Potential exposure of construction workers to hazardous levels of contaminants during construction of leachate collection system, cap, and groundwater collection system. Contact with contaminated soil and high temperatures of rotary kiln are operational safety concerns.	Potential for exposure of construction workers during excavation is very high.

TABLE 3-1 (Sheet 4 of 4)
TECHNICAL EVALUATION OF ALTERNATIVES
ECC-NSL CAA

the possibility of increasing contaminant levels by greatly reducing leachate generation.

Alternatives 4 through 8 would be effective in the case of increasing contaminant types or levels in the future. Alternative 4 allows leaching of soil and landfill contaminants in the unsaturated zone to the groundwater with their subsequent collection and treatment. Though in some cases this can be used as a means of contaminant removal from soils, at ECC and NSL it would not be very effective. This is because many contaminants have very long travel times between the contaminant source and the collection system, possibly in excess of 100 years. The collection and treatment system of Alternative 4 may require operation indefinitely.

Alternative 5 includes a RCRA cap to greatly reduce contaminant migration from the unsaturated zone to the groundwater. This will reduce the treatment necessary for the collected groundwater and leachate and would likely result in a shorter operational period of the collection and treatment system for groundwater. Alternatives 6, 7, and 8 include the groundwater isolation system in addition to the RCRA cap. The object of the system is to prevent further contamination of the groundwater and eventually (in 5 to 15 years) result in treatment of leachate only.

Alternatives 7 and 8 do not rely as heavily as other alternatives on performance of deed restrictions for preventing ECC site excavation and exposure to contaminants in soil. The soil vapor extraction of Alternative 7 would remove the majority of soil contaminants posing public health risks from direct contact, inhalation, or ingestion. The soil incineration of Alternative 8 results in destruction of all organic contaminants in soils with contaminants above the 10^{-6} cancer risk level. Alternative 9 would be the most effective in addressing all the remedial action goals since all contaminants are isolated from environmental media.

<u>Reliability</u>

Alternatives differ in their reliability to perform effectively (especially in the long-term where contaminant levels and types may increase). Alternatives 2 and 3 place a heavy reliance on monitoring to detect increases in contaminant levels or types. The average travel time of groundwater contaminants between detection and discharge to the surface waters is estimated to be about 8 months in the till and will be shorter for contaminants moving through lenses of sand and gravel. This may not be sufficient time for implementation of the necessary remedial actions to collect contaminated groundwater before it reaches Finley Creek.

The long-term reliability of the RCRA cap of Alternatives 3, 5, 6, 7, 8, and 9 to continue performing effectively has not been demonstrated, though it is believed to be good if regular maintenance is performed. The reliability of groundwater collection systems is good although the groundwater isolation system of Alternatives 6, 7, and 8 is more complex and thus may be less reliable than the interception systems of Alternatives 4 and 5 to perform as designed. The reliability of the isolation system in protection of public health and environment, however, is greater than the interception systems since they provide much longer times between collection system failure and release of groundwater contaminants to surface water. The groundwater and leachate treatment systems have a high degree of flexibility to treat varying contaminant types and levels and are considered reliable.

The reliability of the soil vapor extraction of Alternative 6 is difficult to assess until pilot testing at ECC is performed, although it has proved reliable at other sites. The soil incineration of Alternative 7 is considered reliable in destroying organic contaminants. The long-term reliability of the RCRA landfill of Alternative 8 is difficult to assess since RCRA landfills do not yet have a long operational history. However, given substantial maintenance and replacement costs, the reliability of Alternative 8 is believed to be good.

Implementability

Implementation of each of the alternatives (except No Action) will require extensive construction because the NSL site is so large. Alternative 2 will be the easiest to implement since it has the fewest components to construct. Installation of a groundwater interception system makes Alternatives 4 and 5 more difficult to implement than Alternative 2. Alternatives 3, 5, 6, 7, and 8 require additional construction time and expertise for the RCRA cap. Alternatives 6, 7, and 8 will be more difficult to construct than Alternative 3 because of the installation of a groundwater isolation system.

Alternative 7 requires 2 to 4 years for operation of the soil vapor extraction system. The RCRA cap would not be placed over ECC until operation was complete. Incineration of ECC soil in Alternative 8 requires an additional 3 to 4 years before construction of the cap.

Alternative 9 will be the most difficult to implement because of the difficulty and time involved in excavating the existing landfill and constructing a RCRA-type landfill onsite.

Safety

The risk to public health and environment in the event of a system failure is largely related to the time available between detection of the system failure and implementation of corrective action. Failure of the monitoring program of any of the alternatives to detect offsite contaminant migration could result in adverse health or environmental effects. Failure of the groundwater collection or treatment systems of Alternatives 4, 5, 6, 7, and 8 would likely be detected before significant adverse effects occur. In the event of treatment system failure, untreated leachate would be stored in a holding tank until the system becomes operational. The groundwater collection systems could be shut down until the treatment system was operational since contaminated groundwater would not have sufficient time to migrate beyond the collection area.

If a collection system failure were not detected the groundwater isolation system of Alternatives 6, 7, and 8 would allow much greater time before adverse effects could occur since it would take additional time for the water table to rise into the zone of contaminated soil at ECC or NSL. Remediation could also likely be undertaken in Alternative 9 before adverse health or environmental effects occur because of a release from the RCRA landfill. The potential for exposures of construction workers is a major concern for the excavation of the NSL landfill in Alternative 9.

INSTITUTIONAL/PUBLIC HEALTH/ENVIRONMENTAL ANALYSIS

In the detailed evaluation and final selection of a remedial action alternative, adequate protection of public health, welfare, and the environment is a major concern. The National Contingency Plan requires for each alternative:

(D) An assessment of the extent to which the alternative is expected to effectively mitigate, or minimize threats to, and provide adequate protection of, public health, welfare, and the environment [40 CFR 300.68(h)(2)(iv)].

(E) An analysis of any adverse environmental impacts, methods for mitigating these impacts, and costs of mitigation [40 CFR 300.68(h)(2)(vi)].

In this section, each alternative undergoing detailed analysis is evaluated with regard to its impact on institutional, environmental, and public health concerns. This analysis evaluates short-term (construction-related) impacts, those impacts related to the operation of the remedial technology, and the final results of the remedial action alternative.

The institutional analysis examines the ability of each alternative to attain federal, state, and local environmental and public health standards, regulations, guidance, advisories, and ordinances. Included in this analysis is a consideration of land use and zoning.

The public health analysis considers a broad range of public health and welfare concerns. Criteria used in evaluating the impact on public health and welfare are: public health risks; odor, noise, air and water pollution impacts; disruption and dislocation of households, businesses, and services; aesthetics; impact on prime farmland, parks, and recreation; impact on traffic.

The environmental analysis evaluates such impacts as wildlife habitat alteration; water pollution; toxic and adverse effects on plants and wildlife; impacts on threatened and endangered species; natural resource loss and diminution; and impacts on wetlands and unique resources.

INSTITUTIONAL ISSUES

This section discusses federal, state, and local environmental and public health laws, regulations, and policies that may affect the implementation of remedial action alternatives. As a general rule, it is EPA's policy that in CERCLA remedial actions, "applicable or relevant and appropriate Federal" public health and environmental requirements must be complied with.

Applicable laws and standards are those that would be specifically triggered when the law or regulation is clearly and indisputably the controlling authority for the planned action for the proposed Superfund remedy except that the proposed action would be undertaken pursuant to CERCLA Section 104 or 106; e.g., applicable laws and standards are those that would legally apply if the action was not being taken under the authority of CERCLA. Relevant and appropriate laws or standards are those where the intent of the law or standard is to apply to circumstances sufficiently similar to those encountered at CERCLA sites. The term "relevant and appropriate" means that the law or regulation need not be truly applicable or legally required to the proposed action or existing circumstances but that the intent of the law was to control similar situations.

EPA does not require permits for onsite fund-financed or enforcement actions taken under CERCLA. Certain permits are, however, required for offsite actions involving treatment, storage, or disposal beyond the site boundaries. Examples are wastewater discharges and disposal of hazardous wastes.

Federal, state and local laws, regulations, and policies are reviewed for applicability to the remedial action alternatives in this study. Applicable requirements considered important "institutional" issues in comparing remedial action alternatives are reviewed in more detail in the following discussion. These issues include hazardous waste management, wastewater discharges, and contaminant emissions to the atmosphere.

Coordination with Other Agencies

The NCP states in 40 CFR300.22 that federal agencies should coordinate their planning and response activities through mechanisms outlined in Subpart C of the NCP. The duty to manage certain aspects of CERCLA responses has been delegated to several federal agencies. Those federal agencies that may have responsibilities in the CERCLA response to the ECC and NSL sites are listed in Table 3-2.

Compliance with Environmental Statutes

Not all federal environmental laws and regulations are applicable to each CERCLA response action. For the combined alternatives developed for the ECC and NSL sites, several federal environmental laws and regulations are not applicable. These laws and regulations, along with the reasons for their nonapplicability, are set out in Table 3-3. Alternatives and relevant laws are shown in Table 3-4.

Summary of Institutional Issues

This analysis addresses the impacts of each alternative on the basis of interplay between implementation of the alternative and institutional constraints. Criteria used in evaluating the institutional impacts are political jurisdictions; relevant and applicable federal and state standards; need for land acquisition; changes in land use and zoning; local/state/federal laws or policies; and need for permits and permit-like restrictions. These impacts are summarized in Table 3-5.

GENERAL PUBLIC HEALTH CONCERNS

The public health risk assessment of the No Action alternative highlighted two major exposure concerns. They include exposure to contaminants in subsurface soil and leachate sediment primarily through direct contact/ingestion and exposure to contaminants in groundwater as a result of potable water use of the aquifer. Each alternative is specifically evaluated for its impact on mitigating these potential exposures.

Table 3-2
FEDERAL AGENCY COORDINATION

Agency	Comments
Federal Emergency Management Agency[a] (FEMA)	No alternative requires relocation of a business operation.
Dept. of Health & Human Services (HHS)	All alternatives that involve action will be preceded by a contact with HHS to request the appropriate support.
U.S. Army Corps of Engineers (COE)	All alternatives that involve fund financed action may be managed by the COE. COE may be contacted when EPA has selected a remedial action and is prepared to proceed.
Dept. of Labor Occupational Safety and Health Administration (OSHA)	All alternatives that involve onsite action may require OSHA contact before action to provide input and assistance if necessary.
Department of Transportation (DOT)	All alternatives that require offsite transportation of contaminated media will comply with DOT regulations regarding the transportation of hazardous materials.
U.S. Fish and Wildlife Service (USFWS)	Some game species and fish may be affected if the access restriction or No Action alternative is implemented.
Bureau of Land Management (BLM)[a]	No federal lands are involved in the implementation of alternatives.
Advisory Council on Historic Preservation[a]	No landmarks, historic sites, or areas of historic, scientific, or cultural interest will be affected by the implementation of alternatives.
U.S. Forest Service (USFS)[a]	No wild and scenic rivers will be affected by implementation of alternatives.
Department of Housing and Urban Development (HUD)	Portions of the NSL site lie in a flood plain; therefore, HUD flood plain maps will be required for the site.

[a]Coordination with this agency not anticipated to be needed at this site.

Table 3-3

FEDERAL ENVIRONMENTAL LAWS, REGULATIONS, POLICIES, AND STANDARDS REVIEWED AND FOUND NOT APPLICABLE TO ALTERNATIVES

Law, Regulation or Policy	Applicability
Safe Drinking Water Act, Underground Injection Control (UIC) Program: Criteria and Standards (40 CFR Part 146)	None of the alternatives includes the underground injection of any materials.
40 CFR 403 Effluent Guidelines and Standards Pretreatment Standards	None of the alternatives includes discharge of effluent to POTW.
Marine Protection, Research and Sanctuaries Act (40 CFR Part 220-229) Ocean Dumping Requirements	Implementation of the alternatives does not include the dumping of any materials in the ocean or incineration at sea.
Radioactive Waste Rule--High and Low Level	Existing records do not indicate that the site contains high- or low-level radioactive waste.
National Register of Historic Places	Implementation of the alternatives should not affect sites on the register.
Wild and Scenic Rivers Act (40 CFR Part 6.302)	Rivers on the national inventory will not be affected by alternatives.
Endangered Species Act Protection of Threatened or Endangered Species and Their Habitats (50 CFR Part 402)	Implementation of the alternatives should not affect threatened or endangered species and their habitat.
Fish and Wildlife Act Conservation of Wildlife Resources	Implementation of the alternatives should not affect areas of important wildlife resources.
Coastal Zone Management Act (15 CFR 920-926)	Implementation of the alternatives will not affect a coastal zone.
National Environmental Policy Act (NEPA)	CERCLA actions are exempted from the NEPA requirement because EPA's decision-making process in selecting a remedial action alternative is the functional equivalent of the NEPA analysis.
Archaeological and Historic Preservation Act of 1974	No such resources are expected to be affected by the alternatives.

Table 3-4 (Page 1 of 4)
ALTERNATIVES COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Analysis	Alternative 1	2	3	4	5	6	7	8	9
FEDERAL										
Resource Conservation and Recovery (RCRA) - Subtitle C										
40 CFR 264-265 Standards for owners and operators of hazardous waste treatment, storage and disposal facilities.	This alternative may not be consistent with current RCRA regulations.	X	X							
	This alternative will require use of an RCRA-type facility meeting the technical requirements of current RCRA Subtitle C requirements.									X
Clean Air Act (CAA)	Implementation of this alternative may result in the emission of pollutants into the air though below regulatory limits. A permit may not be required, but any necessary technical requirements will be met.			X	X	X	X	X	X	X
	Onsite excavation will result in the short-term emission of particulates. Onsite personnel will be adequately protected. Efforts to mitigate release will be made.								X	X
Clean Water Act (CWA)										
40 CFR Parts 122, 125 and Subpart N National Pollutant Discharge Elimination System (NPDES)	Indiana has authorization to administer NPDES in Indiana. Refer to section on state regulation.									

Table 3-4 continued (2 of 4)

Law or Regulation	Analysis	Alternative 1	2	3	4	5	6	7	8	9
DOT Hazardous Materials Transport Rules (49 CFR Subchapter C) and RCRA Subtitle C Standards for Transporters 40 CFR 263	Implementation of this alternative includes the offsite transport of contaminated water from dewatering of cooling pond or contaminated treatment system sludge. The transport of these materials will be in compliance with these rules, including use of properly constructed and marked transport vehicles, use of a licensed transporter and use of a hazardous waste manifest.		X	X	X	X	X	X	X	
Federal Water Quality Criteria (FWQC)	Implementation of this alternative may not result in compliance with FWQC in surface water.	X	X	X						
EPA Groundwater Protection Strategy	This alternative may not attain EPA's groundwater protection strategy goals for a class II aquifer.	X	X	X						
Occupational Safety & Health Act (OSHA) Part 1910 (OSHA Standards)	Implementation of this alternative will require work on the site. Working conditions must assure safety and health of workers.		X	X	X	X	X	X	X	X
Toxic Substances Control Act (TSCA) 40 CFR 761	Alternative may require disposal of PCB-contaminated material; however, PCB levels may not be at concentrations triggering disposal requirements. Material cannot be spread along roadways.								X	X
Intergovernmental Review of Federal Programs 40 CFR 29	Alternative may require intergovernmental review of project since project may use federal funds.		X	X	X	X	X	X	X	X

Table 3-4 continued (3 of 4)

Law or Regulation	Analysis	Alternative 1	2	3	4	5	6	7	8	9
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1979 (40 CFR 4)	Implementation of the alternatives should not require relocation of residences or businesses but may require acquisition of property.		X	X	X	X	X	X	X	X
Executive Orders for Flood Plain (EO11988)	Implementation of this alternative will affect flood plains.		X	X	X	X	X	X	X	X
Executive Orders for Wetlands (EO11990)	Implementation of this alternative will affect some wetland area.		X	X	X	X	X	X	X	X
STATE Indiana Hazardous Waste Management Program - Indiana Environmental Management Board Article 4 (320-1AC-4)										
Rules, 2, 3, and 4 Water Generation Identification, Standards for Generators	This alternative will involve offsite disposal of hazardous waste and generator regulations apply.		X	X	X	X	X	X	X	
Rule 6 Standards Applicable to Owners and Operators of Hazardous Waste Facilities	This alternative may not be consistent with current state regulations.	X	X	X						
Rule 7 Closure/Postclosure	This alternative may be consistent with current state regulations although no permit will be required.				X	X	X	X	X	X
Rule 8-9 Hazardous Waste Facility Construction and Operating Permit	This alternative will require the use of a state-permitted facility in compliance with current state regulations.		X	X	X	X	X	X	X	X

Table 3-4 continued (4 of 4)

Law or Regulation	Analysis	Alternative 1	2	3	4	5	6	7	8	9
Indiana Waste Treatment Facilities Regulation - Title 330 - Article 3.1 Facility Construction	This alternative will require construction of a waste treatment facility and will be consistent with the technical requirement of Article 3.1.		X	X	X	X	X	X	X	X
Article 5 Industrial Waste-water Pretreatment and NPDES Programs - Rules 1 - 10	Implementation of this alternative may result in an onsite point source discharge. An NPDES permit will be required.		X	X	X	X	X	X	X	X
Rules 11-15 Pretreatment Standards	Not applicable. Implementation of this alternative may not result in discharge of a waste stream to a publicly-owned treatment works (POTW).	X	X	X	X	X	X	X	X	X
Indiana Water Quality Standards Stream Pollution Control Board 330 (AC Article 1-2, Section 6 Water Quality Standard	Implementation of this alternative may not result in compliance with Indiana Water Quality Standards	X	X	X						
Indiana Air Pollution Control	This alternative may be consistent with the technical requirement of current Indiana regulation although no permit will be required.		X	X	X	X	X	X	X	X
Indiana Department of Natural Resources	This alternative will require a permit to construct in floodways.		X	X	X	X	X	X	X	X
<u>LOCAL</u>										
Zoning	This alternative may require zoning change.	X	X	X	X	X	X	X	X	X

Table 3-5 (Page 1 of 2)
SUMMARY OF INSTITUTIONAL IMPACTS OF ALTERNATIVES

Alternative	Comment
1--No Action	Uncontrolled hazardous waste site does not meet goals of CERCLA. Groundwater in violation of drinking water quality criteria. Surface water exceeds ambient water quality criteria for protection of human health.
2--Access Restrictions, with Soil Cover, Leachate Collection and Treatment	Contaminants not removed. Potential future direct contact and incompatible use eliminated. Water quality criteria may be violated. May need to acquire land and implement deed restrictions. The potential for releases of contaminanted groundwater from the site continues, so policy goal of CERCLA may not be met. Alternative must be implemented to minimize impact on flood plain and wetland areas.
3--Access Restrictions with RCRA Cap, Leachate Collection and Treatment	Contaminants not removed. Potential for future direct contact and compatible use eliminated. Alternative must be implemented to minimize impact on flood plain and wetland areas. Water quality criteria may be violated. May need to acquire land and implement deed restriction. The potential for releases of contaminated groundwater from the site continues, so policy goal of CERCLA may not be met.
4--Access Restrictions with Soil Cover, Leachate Collection, and Groundwater Interception and Treatment	Contaminants not removed. The CERCLA goal of protection of public health, welfare, and environment is achieved. Alternative must be implemented to minimize impact on flood plain and wetland areas.
5--Access Restrictions with RCRA Cap, Leachate Collection and Groundwater Interception and Treatment.	Contaminants not removed. The CERCLA goal of protection of public health, welfare, and the environment is achieved. All standards will be met. Alternatives must be implemented to minimize impact on flood plain and wetland area.
6--Access Restrictions with RCRA Cap, Leachate Collection, and Groundwater Isolation and Treatment	Contaminants not removed. Isolation of contaminants from groundwater. All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved. Alternative must be implemented to minimize impact on flood plain and wetland areas.

Table 3-5 (Page 2 of 2)

Alternative	Comment
7--Access Restrictions with RCRA Cap, Leachate Collection, and Groundwater Isolation and Treatment and ECC Soil Vapor Extraction	Majority of ECC soil contaminants removed. Isolation of contaminants from groundwater. All standards will be met. CERCLA goals will be met. Alternative must be implemented to minimize impact on flood plain and wetland areas.
8--Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration	Majority of ECC soil contaminants destroyed. Isolation of contaminants from groundwater. All standards will be met. CERCLA goals will be met. Requires delisting of residue to dispose of it onsite. No permits required but need to follow technical requirements. Alternative must be implemented to minimize impact on flood plain and wetland areas.
9--Access Restrictions with Onsite RCRA Landfill	Contaminants isolated. All standards will be met. Waste is secured in a more reliable facility. CERCLA goals will be met. Alternative must be implemented to minimize impact on flood plain and wetland areas.

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PUBLIC HEALTH/ENVIRONMENTAL ASSESSMENT OF ALTERNATIVES

Alternative 1--No Action

Existing and potential future endangerment to public health, welfare, and the environment would not be mitigated. Access to the site would not be restricted and people could come into direct contact with contaminants in the soil and sediment. Contaminants have the potential to release from the fill to the surface water via leachate or groundwater.

Because the nature of the contaminants in the fill is not known, it is not possible to predict the nature of contaminant releases. Consequently, future impacts cannot be addressed in terms of exceeding numerical public health and environmental criteria. However, because a potentially complete groundwater exposure pathway will exist under this alternative, there is a concern for potential adverse public health and environmental impacts if future releases of contaminants should occur. The adjacent surface waters would be vulnerable to future releases of contaminants from groundwater and leachate discharges. The potential adverse health and environmental effects of No Action were presented earlier in Tables 2-1 and 2-2.

Alternative 2--Access Restrictions with Soil Cover and Leachate Collection and Treatment

Access restrictions, sediment reconsolidation, stream relocation, leachate collection and treatment, fencing, monitoring, and a soil cover would greatly reduce the potential for exposures from direct contact with contaminated soil and sediment as well as minimize environmental impacts that could result from contact of wildlife with site contaminants. There would be no restrictions, however, on the potential release of contaminants to the groundwater and, as discussed in the No Action alternative, this could result in public health and environmental impacts. Releases of contaminants to groundwater and surface waters could continue for over 100 years. The aesthetics of the landfill would be improved by placement of a vegetated cover.

There may be minor dust releases and noise during sediment excavation and reconsolidation, grading of site, and application of soil cover. Short-term adverse construction effects on aquatic habitat may occur because of stream relocation.

Difficulties may be encountered in implementing and enforcing institutional and access controls for periods in excess of 100 years. For example, the effectiveness of land use and groundwater use restrictions for long-term actions has not been established. Failure of use restrictions could result in exposure to contaminants at some future time. This alternative may require zoning changes and it would be necessary to institute use restrictions on the deed.

Alternative 3--Access Restrictions with RCRA Cap and Leachate Collection and Treatment

The public health and environmental impacts are similar to Alternative 2. Potential environmental impacts from the discharge of contaminated groundwater to the surface water remains unabated under this alternative, potentially resulting in a diminution of the natural resources. Capping the sites, however, will reduce leachate and lessen the possibility of increasing groundwater and surface water contaminant levels in the future. Releases to the groundwater and surface water would still be expected for over 100 years.

The short-term impacts of applying the RCRA cap are from noise, dust generation, and traffic. Noise and dust would be generated by truck traffic in and out of the landfill as well as heavy construction equipment working onsite. Residents, however, currently experience such nuisances from garbage trucks and onsite equipment during normal landfill operation. As in Alternative 2, the difficulties in implementing access restrictions for periods in excess of 100 years are a concern.

Alternative 4--Access Restrictions with Soil Cover, Leachate Collection, Groundwater Interception, and Treatment

Alternative 4 mitigates public health and environmental impacts of the NSL site. The alternative is similar to Alternatives 2 and 3 with regard to preventing human contact with contaminants in the soil and sediment, but it also prevents releases to the surface waters. Groundwater interception precludes the release of contaminants to the surface water, eliminating the exposure pathway to the natural environment and downstream surface water users. Aquatic habitat in Finley Creek may improve over time as a result of cessation of discharges.

Short-term construction impacts such as noise, dust, and traffic disruption would be similar to Alternative 2 with the exception of some small increases in disturbances from the installation of the groundwater interception system.

Alternative 5--Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Interception and Treatment

Public health and environmental impacts of Alternative 5 are similar to Alternative 4. The presence of the RCRA cap will greatly reduce the leaching of contaminants from contaminated soils to the groundwater and may result in a shorter period over which onsite groundwater exceeds drinking water standards.

Construction impacts would be similar to those discussed in Alternative 3 and 4.

Alternative 6--Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Isolation, and Treatment

Public health and environmental impacts of Alternative 6 are essentially the same as Alternative 5. The lowering of the water table below the zone of soil contamination will likely reduce groundwater contamination beneath the sites to levels below water quality criteria and standards. This may occur within 5 years of implementation.

Construction impacts would be similar to those discussed in Alternative 3, except the installation of the groundwater isolation system would cause small increases in noise and dust generation.

Alternative 7--Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Vapor Extraction

The public health and environmental impacts of Alternative 7 would be approximately the same as the impacts of Alternative 6, except that the ECC soil vapor extraction system would reduce the generation of contaminated leachate and reduce public health risks in the event of future site excavation.

Alternative 8--Access Restrictions with RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration

The public health and environmental impacts of Alternative 8 would be similar to Alternative 6, except that ECC soil incineration would reduce the generation of contaminated leachate at ECC and reduce public health risks in the event of future site excavation. Alternative 8 reduces risks associated with direct contact, inhalation, and ingestion of all organic contaminants as opposed to VOC's only in Alternative 7. Short-term impacts may occur from release of contaminants to air or surface water during the ECC site excavation.

Alternative 9--Access Restrictions with Onsite RCRA Landfill

This alternative is the most protective of the public health, welfare, and the environment. The contaminants in the existing fill would be secured in a facility of known design and construction with redundant monitoring systems to forewarn of impending releases. This alternative has the greatest short-term impacts of all the alternatives. Excavation of the landfill could release volatiles and contaminated dust. The period of construction would also be longer for this alternative than for any of the previous alternatives. Import of materials for liner construction could severely disrupt traffic patterns as well as increase noise and dust generation.

COST ANALYSIS

GENERAL DISCUSSION

Cost estimates for the alternatives were prepared from cost information included in the U.S. EPA's "Compendium of Costs of Remedial Technologies at Hazardous Waste Sites," the 1985 Means Site Work Cost Data guide, Cost Reference Guide for Construction Equipment 1985, estimates for similar projects, and estimates provided by equipment vendors.

Capital and operation and maintenance cost estimates are order-of-magnitude level estimates, that is, the cost estimates have an expected accuracy of +50 and -30 percent. The estimated present worth of remedial alternatives was based on 10-percent discount rate and a 30-year alternative life.

The order-of-magnitude construction cost estimates presented have been prepared from the information available at the time of the estimate. Final costs of alternatives will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, continuity of personnel, engineering between the feasibility study and final design, and other variable factors. As a result, the final alternative costs will vary from the estimates presented in this report. Most of these factors are not expected to affect the relative cost differences between alternatives.

Construction, annual operation and maintenance, and present worth are summarized for each CAA alternative in Tables 3-6, to 3-13. Detailed cost tables for the alternatives are presented in Appendix A.

The cost summary tables also present a breakdown of the alternative costs attributable to the ECC and NSL sites. CAA alternative costs were first developed for each major component and then distributed to either ECC or NSL. Costs were most often distributed based on physical dimensions of the sites. As an example, the cost of the RCRA cap of Alternatives 3, 5, 6, 7, and 8 was separated into preliminary grading, cap construction, and vegetative cover. The preliminary grading component is required at NSL only and no costs were assigned to ECC. The remaining components were divided based on the percentage of the area to be covered. Since about 5 percent of the total cap area is ECC, the cap construction and vegetative cover costs were multiplied by 0.05 to arrive at the ECC cost. Appendix B presents the methodologies used for cost distribution for each alternative.

Table 3-6
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 2 - ACCESS RESTRICTIONS WITH SOIL COVER AND LEACHATE COLLECTION AND TREATMENT

		NSL			ECC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Stabilize land surface										
Preliminary grading - NSL		1,923,000						1,923,000		
Run-off control		141,000						141,000		
Soil & vegetative cover		656,000		171,000	35,000		9,000	691,000		180,000
Access roads - NSL		70,000						70,000		
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000		
Monitoring program		71,000		169,000	10,000		37,000	81,000		206,000
Leachate collection - NSL		435,000		2,300				435,000		2,300
Leachate treatment - NSL		1,426,000	154,000	549,000				1,426,000	154,000	549,000
Access restrictions		101,000		3,100	17,000		500	118,000		3,600
CONSTRUCTION SUBTOTAL		5,030,000			89,000			5,119,000		
Mobilization/demobilization	5%	252,000			4,000			256,000		
Health & Safety	10%	503,000			9,000			512,000		
Bid contingency	15%	755,000			13,000			768,000		
Scope contingency	20%	1,006,000			18,000			1,024,000		
CONSTRUCTION TOTAL		7,546,000			133,000			7,679,000		
Permitting & Legal	5%	377,000			7,000			384,000		
Services during construction		246,000			4,000			250,000		
TOTAL IMPLEMENTATION COST		8,169,000			144,000			8,313,000		
Engineering design cost		393,000			7,000			400,000		
TOTAL CAPITAL COST		$8,562,000			$151,000			$8,713,000		
PRESENT WORTH REPLACEMENT COST			$154,000			$0			$154,000	
ANNUAL OPERATION & MAINTENANCE				$894,000			$47,000			$941,000
TOTAL PRESENT WORTH (c)				$17,501,000			$613,000			$18,114,000 (d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingencies, and final capital, O&M and present worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,669,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $133,000

Table 3-7
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 3 - RCRA CAP, LEACHATE COLLECTION AND TREATMENT

		NSL			ECC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000		
ECC Site Work					144,000			144,000		
Monitoring program		71,000		170,000	10,000		37,000	81,000		207,000
RCRA Cap										
Preliminary grading		1,918,000						1,918,000		
Cap construction		7,669,000	477,000		336,000	21,000		8,005,000	498,000	
Vegetative cover		656,000		171,000	35,000		9,000	691,000		180,000
Leachate collection - NSL		435,000		1,700				435,000		1,700
Leachate treatment		1,426,000	163,000	427,000				1,426,000	163,000	427,000
Access restrictions		101,000		3,100	17,000		500	118,000		3,600
CONSTRUCTION SUBTOTAL		12,483,000			569,000			13,052,000		
Mobilization/demobilization	5%	624,000			28,000			653,000		
Health & Safety	10%	1,248,000			57,000			1,305,000		
Bid contingency	15%	1,872,000			85,000			1,958,000		
Scope contingency	20%	2,497,000			114,000			2,610,000		
CONSTRUCTION TOTAL		18,724,000			853,000			19,578,000		
Permitting & Legal	5%	936,000			43,000			979,000		
Services during construction		383,000			17,000			400,000		
TOTAL IMPLEMENTATION COST		20,043,000			913,000			20,957,000		
Engineering design cost		430,000			20,000			450,000		
TOTAL CAPITAL COST		$20,473,000			$933,000			$21,407,000		
PRESENT WORTH REPLACEMENT COST			$640,000			$21,000			$661,000	
ANNUAL OPERATION & MAINTENANCE				$773,000			$47,000			$819,000
TOTAL PRESENT WORTH (c)				$28,497,000			$1,393,000			$29,891,000 (d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingencies, and final capital, O&M and present worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $795,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $64,000

Table 3-8
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 4 - SOIL COVER, GROUNDWATER INTERCEPTION AND TREATMENT

		NSL			ECC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Stabilize land surface										
Preliminary grading - NSL		1,923,000						1,923,000		
Run-off control		141,000						141,000		
Soil & vegetative cover		656,000		172,000	35,000		9,000	691,000		181,000
Access roads - NSL		70,000						70,000		
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000		
ECC Site Work					251,000			251,000		
Monitoring program		71,000		87,000	10,000		40,000	81,000		127,000
Groundwater interception		160,000		2,900	18,000		300	178,000		3,200
Leachate collection - NSL		435,000		1,700				435,000		1,700
Groundwater collection - ECC					507,000		1,600	507,000		1,600
Groundwater/Leachate Treatment		1,659,000	224,000	591,000	144,000	20,000	73,000	1,803,000	244,000	664,000
Access restrictions		101,000		3,100	17,000		500	118,000		3,600
CONSTRUCTION SUBTOTAL		5,423,000			1,009,000			6,432,000		
Mobilization/demobilization	5%	271,000			51,000			322,000		
Health & Safety	15%	813,000			152,000			965,000		
Bid contingency	15%	813,000			152,000			965,000		
Scope contingency	20%	1,085,000			201,000			1,286,000		
CONSTRUCTION TOTAL		8,405,000			1,565,000			9,970,000		
Permitting & Legal	5%	420,000			79,000			499,000		
Services during construction		211,000			39,000			250,000		
TOTAL IMPLEMENTATION COST		9,036,000			1,683,000			10,719,000		
Engineering design cost		422,000			78,000			500,000		
TOTAL CAPITAL COST		$9,458,000			$1,761,000			$11,219,000		
PRESENT WORTH REPLACEMENT COST			$224,000			$20,000			$244,000	
ANNUAL OPERATION & MAINTENANCE				$858,000			$124,000			$982,000
TOTAL PRESENT WORTH (c)				$17,876,000			$2,965,000			$20,841,000 (d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingencies, and final capital, O&M and present worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,923,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $154,000

Table 3-9
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 5 - RCRA CAP, LEACHATE COLLECTION, AND MODIFIED
GROUNDWATER INTERCEPTION AND TREATMENT

		NSL			ECC			Total			
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	
Remove creek & leachate sediment		129,000						129,000			
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000			
ECC Site Work					251,000			251,000			
Monitoring program		71,000		87,000	10,000		39,000	81,000		126,000	
RCRA Cap											
Preliminary grading		1,918,000						1,918,000			
Cap construction		7,686,000	479,000		579,000	36,000		8,265,000	515,000		
Vegetative cover		684,000		171,000	36,000		9,000	720,000		180,000	
Groundwater interception		326,000		2,300	57,000		400	383,000		2,700	
Leachate collection - NSL		435,000		1,700				435,000		1,700	
Groundwater/leachate treatment		1,659,000	224,000	461,000	144,000	20,000	57,000	1,803,000	244,000	518,000	
Access restrictions		101,000		3,100	17,000		500	118,000		3,600	
CONSTRUCTION SUBTOTAL		13,087,000			1,121,000			14,208,000			
Mobilization/demobilization	5%	654,000			56,000			710,000			
Health & Safety	15%	1,963,000			168,000			2,131,000			
Bid contingency	15%	1,963,000			168,000			2,131,000			
Scope contingency	25%	3,272,000			280,000			3,552,000			
CONSTRUCTION TOTAL		20,939,000			1,793,000			22,732,000			
Permitting & Legal	5%	1,047,000			90,000			1,137,000			
Services during construction		415,000			35,000			450,000			
TOTAL IMPLEMENTATION COST		22,401,000			1,918,000			24,319,000			
Engineering design cost		507,000			43,000			550,000			
TOTAL CAPITAL COST		$22,908,000			$1,961,000			$24,869,000			
PRESENT WORTH REPLACEMENT COST			$703,000			$56,000			$759,000		
ANNUAL OPERATION & MAINTENANCE				$726,000			$106,000			$832,000	
TOTAL PRESENT WORTH (c)				$30,847,000			$3,074,000			$33,921,000	(d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingenc worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $957,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $77,000

Table 3-10
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 6 - RCRA CAP, GROUNDWATERR ISOLATION AND TREATMENT

		NSL			ECC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000		
ECC Site Work					251,000			251,000		
Monitoring program		71,000		87,000	10,000		39,000	81,000		126,000
RCRA Cap										
Preliminary grading		1,918,000						1,918,000		
Cap construction		7,686,000	479,000		579,000	36,000		8,265,000	515,000	
Vegetative cover		684,000		172,000	36,000		9,000	720,000		181,000
Groundwater isolation		1,007,000		7,600	192,000		1,500	1,199,000		9,100
Leachate collection - NSL		435,000		1,700				435,000		1,700
Groundwater collection - ECC					507,000		1,600	507,000		1,600
Groundwater/leachate treatment		1,861,000	88,000	468,000	162,000	8,000	58,000	2,0[illegible]3,000	96,000	526,000
Access restrictions		101,000		3,000	17,000		600	118,000		3,600
CONSTRUCTION SUBTOTAL		13,970,000			1,781,000			15,751,000		
Mobilization/demobilization	5%	699,000			89,000			788,000		
Health & Safety	15%	2,096,000			267,000			2,363,000		
Bid contingency	15%	2,096,000			267,000			2,363,000		
Scope contingency	25%	3,493,000			445,000			3,938,000		
CONSTRUCTION TOTAL		22,354,000			2,849,000			25,203,000		
Permitting & Legal	5%	1,118,000			142,000			1,260,000		
Services during construction		444,000			56,000			500,000		
TOTAL IMPLEMENTATION COST		23,916,000			3,047,000			26,963,000		
Engineering design cost		532,000			68,000			600,000		
TOTAL CAPITAL COST		$24,448,000			$3,115,000			$27,563,000		
PRESENT WORTH REPLACEMENT COST			$567,000			$44,000			$611,000	
ANNUAL OPERATION & MAINTENANCE				$739,000			$110,000			$849,000
TOTAL PRESENT WORTH (c)				$32,945,000			$4,339,000			$37,284,000 (d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30
b. Construction costs, subtotals, contingencies, and final capital, O&M and present worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,201,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $96,000

Table 3-11
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 7 - RCRA CAP, GROUNDWATERR ISOLATION, ECC VAPOR EXTRACTION

		NSL			ECC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000		
ECC Site Work					251,000			251,000		
Monitoring program		71,000		87,000	10,000		39,000	81,000		126,000
RCRA Cap										
Preliminary grading		1,918,000						1,918,000		
Cap construction		7,686,000	479,000		579,000	36,000		8,2[illegible],000	515,000	
Vegetative cover		684,000		172,000	36,000		9,000	720,000		181,000
Groundwater isolation		1,007,000		7,600	192,000		1,500	1,199,000		9,100
Leachate collection - NSL		435,000		1,700				435,000		1,700
Groundwater collection - ECC					507,000		1,600	507,000		1,600
Groundwater/leachate treatment		1,861,000	88,000	468,000	162,000	8,000	58,000	2,023,000	96,000	526,000
ECC soil vapor extraction					500,000		47,000	500,000		47,000
Access restrictions		101,000		3,000	17,000		600	118,000		3,600
CONSTRUCTION SUBTOTAL		13,970,000			2,281,000			16,251,000		
Mobilization/demobilization	5%	699,000			114,000			813,000		
Health & Safety	15%	2,096,000			342,000			2,438,000		
Bid contingency	15%	2,096,000			342,000			2,438,000		
Scope contingency	25%	3,493,000			570,000			4,063,000		
CONSTRUCTION TOTAL		22,354,000			3,649,000			26,003,000		
Permitting & Legal	5%	1,118,000			182,000			1,300,000		
Services during construction		444,000			106,000			550,000		
TOTAL IMPLEMENTATION COST		23,916,000			3,937,000			27,853,000		
Engineering design cost		532,000			118,000			650,000		
TOTAL CAPITAL COST		$24,448,000			$4,055,000			$28,503,000		
PRESENT WORTH REPLACEMENT COST			$567,000			$44,000			$611,000	
ANNUAL OPERATION & MAINTENANCE				$739,000			$157,000			$896,000
TOTAL PRESENT WORTH (c)				$33,457,000			$5,892,000			$39,349,000 (d)

a. Capital and operation and maintenance (O&
with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingencies, and final capital, O&M and present
worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL.
NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB.
IS REQUIRED, THE ADDITIONAL PRESENT WORTH
(WHICH IS NOT INCLUDED) IS : $1,201,000

THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL
IN A RCRA LANDFILL, TO BE SUBTRACTED FROM
THE TOTAL PRESENT WORTH IS : $96,000

Table 3-12
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 8 - RCRA CAP, GROUNDWATER ISOLATION AND TREATMENT,
ECC INCINERATION

		NSL			ECC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27,000			105,000		
ECC Site Work					251,000			251,000		
Monitoring program		71,000		87,000	10,000		39,000	81,000		126,000
RCRA Cap										
Preliminary grading		1,918,000						1,918,000		
Cap construction		7,686,000	479,000		579,000	36,000		8,265,000	515,000	
Vegetative cover		684,000		172,000	36,000		9,000	720,000		181,000
Groundwater isolation		1,007,000		7,600	192,000		1,500	1,199,000		9,100
Leachate collection - NSL		435,000		1,700				435,000		1,700
Groundwater collection - ECC					507,000		1,600	507,000		1,600
Groundwater/leachate treatment		1,861,000	88,000	468,000	162,000	8,000	58,000	2,023,000	96,000	526,000
ECC soil incineration					22,000,000			22,000,000		
Access restrictions		101,000		3,000	17,000		600	118,000		3,600
CONSTRUCTION SUBTOTAL		13,970,000			23,781,000			37,751,000		
Mobilization/demobilization	5%	699,000			1,189,000			1,888,000		
Health & Safety	15%	2,096,000			3,567,000			5,663,000		
Bid contingency	15%	2,096,000			3,567,000			5,663,000		
Scope contingency	25%	3,493,000			5,945,000			9,438,000		
CONSTRUCTION TOTAL		22,354,000			38,049,000			60,403,000		
Permitting & Legal	5%	1,118,000			1,902,000			3,020,000		
Services during construction		444,000			556,000			1,000,000		
TOTAL IMPLEMENTATION COST		23,916,000			40,507,000			64,423,000		
Engineering design cost		532,000			1,468,000			2,000,000		
TOTAL CAPITAL COST		$24,448,000			$41,975,000			$66,423,000		
PRESENT WORTH REPLACEMENT COST			$567,000			$44,000			$611,000	
ANNUAL OPERATION & MAINTENANCE				$739,000			$110,000			$849,000
TOTAL PRESENT WORTH (c)				$32,945,000			$43,199,000			$76,144,000 (d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingencies, and final capital, O&M and present worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.
2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,201,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $96,000

Table 3-13
COMBINED ALTERNATIVE ANALYSIS COST SUMMARY (a,b)
ALTERNATIVE 9 - ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

		NSL			EDC			Total		
		Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance	Capital Cost	Present Worth Replacement Cost	Average Annual Operation & Maintenance
Remove creek & leachate sediment		129,000						129,000		
Reroute Finley Creek & unnamed ditch		78,000			27000			105,000		
Monitoring program		71,000		100,000	10000		45,000	81,000		145,000
RCRA Landfill										
Site preparation		7,290,000			225000			7,515,000		
Berm construction		4,534,000			140000			4,674,000		
RCRA Multilayer liner		8,505,000			263000			8,768,000		
Move contaminated soil and landfill contents		19,893,000			615000			20,508,000		
Backfill excavated landfill		11,842,000			366000			12,208,000		
RCRA multilayer cap		6,331,000	363,000	122,000	196000	11000	4000	6,527,000	374,000	126,000
Access restrictions		95,000		3,000	15000		600	110,000		3,600
CONSTRUCTION SUBTOTAL		58,768,000			1,857,000			60,625,000		
Mobilization/demobilization	7%	4,114,000			130,000			4,244,000		
Health & Safety	5%	2,938,000			93,000			3,031,000		
Bid contingency	15%	8,815,000			279,000			9,094,000		
Scope contingency	35%	20,569,000			650,000			21,219,000		
CONSTRUCTION TOTAL		95,204,000			3,009,000			98,213,000		
Permitting & Legal	5%	4,760,000			150,000			4,911,000		
Services during construction		679,000			21,000			700,000		
TOTAL IMPLEMENTATION COST		100,643,000			3,180,000			103,824,000		
Engineering design cost		969,000			31,000			1,000,000		
TOTAL CAPITAL COST		$101,612,000			$3,211,000			$104,8[illegible]4,000		
PRESENT WORTH REPLACEMENT COST			$363,000			$11,000			$374,000	
ANNUAL OPERATION & MAINTENANCE				$225,000			$50,000			$275,000
TOTAL PRESENT WORTH (c)				$104,338,000			$3,747,000			$108,086,000 (d)

a. Capital and operation and maintenance (O&M) cost estimates are order of magnitude level estimates with an expected accuracy of +50 to -30 percent, and are rounded to the nearest $1,000.
b. Construction costs, subtotals, contingencies, and final capital, O&M and present worth estimates are rounded to the nearest $1,000.
c. The estimated present worth is based on 10 percent discount rate, and 30-year alternative life.
d. Present worth taken from Appendix A.

ASSUMPTIONS

Total capital costs are those expenditures required to initiate and install a remedial action. Both direct and indirect costs are considered in the development of capital costs. Direct costs include construction costs or expenditures for equipment, labor, and materials required to install a remedial action. Indirect costs consist of engineering, permitting, supervising, and other services necessary to carry out a remedial action.

Because this feasibility study is conceptual and based on data available at the time, bid and scope contingencies were estimated to account for unknown costs. Bid contingencies account for a variety of factors that would tend to increase costs associated with constructing a given project scope, such as economic/bidding climate, contractors inexperienced in working on hazardous waste sites, contractors' uncertainty regarding liability and insurance on hazardous waste sites, adverse weather conditions, strikes by material suppliers, and geotechnical unknowns. Scope contingencies cover changes which invariably occur during final design and implementation. Scope contingencies include provisions for items such as inherent uncertainties in defining waste volumes and regulatory or policy changes that may affect FS assumptions. Allowances for price inflation and abnormal technical difficulties are not accounted for in the contingencies.

Present worth was determined over a 30-year period to allow for comparison of costs over that period. It should be noted that costs will continue to accrue where operation and maintenance is required after the 30-year period; however, the present-worth analysis does not reflect these additional costs. As per U.S. EPA guidance, no cost expenditures in the future are escalated to reflect inflation. A 10-percent discount rate is applied to future values in computing present worth.

Health and safety requirements are estimated to include Levels C and D personal protective equipment. During construction, vehicle decontamination would be required for all vehicles having direct contact with contaminated soil and landfill wastes. During final demobilization of equipment, the vehicles and hand equipment used onsite would be steam cleaned. Workers who would be exposed to the contaminated soil during onsite activities would receive physical examinations before and after all phases of activity involving direct worker exposure to contaminated elements of the site. These elements of health and safety measures are covered in a supervision/health and safety contingency designed to include costs incurred for work on hazardous waste sites above and beyond those incurred on traditional construction jobs.

GLT655/11

Chapter 4
U.S. EPA'S RECOMMENDED ALTERNATIVE

This chapter presents the process U.S. EPA used to obtain the recommended alternative for the ECC and NSL sites. The NCP [Section 300.68(i)] requires the U.S. EPA to select the "cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment." The NCP also requires U.S. EPA to select a remedial action that attains or exceeds applicable or relevant and appropriate federal public health and environmental requirements.

This chapter presents a summary of the alternatives discussed in Chapters 2 and 3 followed by a comparison and presentation of the recommended alternative. Since the development of alternatives for this feasibility study required many simplifying assumptions, the actual design features incorporated into the design of the recommended action may differ from the technologies described here. The objectives and major components of the alternative will remain the same.

A summary of the technical, public health, environment, institutional and cost evaluations of each alternative is presented in Table 4-1.

COMPARISON OF ALTERNATIVES

ALTERNATIVE 1--NO ACTION

The No Action Alternative does not mitigate or minimize the existing threats to public health and environment identified in the endangerment assessments for the sites and summarized in Chapter 1 of this report. Potential adverse effects exist for exposure to contaminants in soils, landfill contents, sediment, leachate, groundwater, and surface waters. Since remedial actions are required to mitigate or minimize these existing or potential exposures, the No Action Alternative is not recommended by U.S. EPA.

ALTERNATIVE 2--ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION AND TREATMENT

Alternative 2 includes site fencing; deed restrictions preventing future site development or use of groundwater onsite; a soil cover; removal of contaminated sediment; rerouting of portions of Finley Creek and the unnamed ditch; long-term surface water, sediment, and groundwater monitoring; and leachate collection and treatment. The total present worth of this alternative is $18,100,000. These actions are considered by EPA to be effective in mitigating and minimizing threats to public health and the environment from exposure

EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Access Restrictions With Soil Cover, Leachate Collection and Treatment	ALTERNATIVE 3 Access Restrictions With RCRA Cap, Leachate Collection and Treatment	ALTERNATIVE 4 Access Restrictions With Soil Cover, Leachate Collection, Groundwater Interception and Treatment	ALTERNATIVE 5 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Interception and Treatment
Technical	Potential exists for adverse health effects resulting from exposure to subsurface soil, landfill contents, and leachate sediments and sediments in the old creek beds of Finley Creek. Soil cover at ECC may pose low level public health risk. Potential exists for adverse effects to public health and environment from future releases of contaminants in leachate. Potential exists for adverse health effects from consumption of contaminated groundwater or fish that have bioconcentrated contaminants. Potential exists for adverse effects on public health and environment from future releases of contaminants to surface water.	Effective in protecting public health from direct contact with soil contaminants given proper implementation of deed restrictions and maintenance of soil cover for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with leachate contaminants by eliminating surface leachate discharge. Leachate collection and soil cover eliminates leachate discharges to surface water. Leachate can still migrate to groundwater. Migration of contaminated groundwater to surface water is not eliminated. Groundwater and surface water monitoring should allow detection of contaminants posing risks. However, sufficient time to implement remedial action may not be available before public health or environment are affected. Monitoring frequency and comprehensiveness are critical to successful implementation. Estimated time of design and construction is 6 months to 1 year.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with leachate contaminants by eliminating surface leachate discharge. Leachate collection and RCRA cap eliminates leachate discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Migration of contaminated groundwater to surface water is not eliminated, although would be reduced relative to Alternative 2. Groundwater and surface water monitoring should allow detection of contaminants posing risks. However, sufficient time to implement mitigative action may not be available before health or environment are affected. Monitoring frequency and comprehensiveness are critical to successful implementation. Estimated time of design and construction is 1 to 2 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of soil cover for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with leachate contaminants by eliminating surface leachate discharge. Leachate and groundwater collection and soil cover eliminates discharges to surface water. Leachate can still migrate to groundwater which is subsequently collected and treated. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater interception and treatment system. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional storage volume should be considered. Estimated time of design and construction is 1 year.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates leachate discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater interception and treatment system. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Estimated time of design and construction is 1 year.
Public Health and Environment		Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Minor dust releases and noise generation during site work.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation Noise and dust generated by truck traffic during RCRA cap construction.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation Minor dust releases and noise generation during site work. Aquatic habitat improves over time because of cessation of contaminant discharge to Finley Creek.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Noise and dust generated by truck traffic during RCRA cap construction. Aquatic habitat improves over time because of cessation of contaminant discharge to Finley Creek.
Institutional	Uncontrolled hazardous waste site does not meet goals of CERCLA. Groundwater in violation of drinking water quality criteria. Surface water exceeds ambient water quality criteria for protection of human health.	Water quality criteria may be violated. May need to acquire land and implement deed restrictions. The potential for releases of contaminated groundwater from the site continues, so policy of CERCLA may not be met.	Water quality criteria may be violated. May need to acquire land and implement deed restrictions. The potential for releases of contaminated groundwater from the site continues, so policy of CERCLA may not be met.	The CERCLA goal of protection of public health, welfare, and environment is achieved.	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.
COST					
Capital	-0-	$ 8,710,000	$21,400,000	$11,200,000	$24,900,000
Annual Average Operation and Maintenance	-0-	941,000	819,000	982,000	832,000
Total Present Worth	-0-	18,100,000	29,900,000	20,800,000	33,900,000

TABLE 4-1 (Page 1 of 2)
SUMMARY OF DETAILED EVALUATION OF ALTERNATIVES
ECC-NSL CAA

EVALUATION CRITERIA	ALTERNATIVE 6 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment	ALTERNATIVE 7 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Vapor Extraction	ALTERNATIVE 8 Access Restrictions With RCRA Cap, Leachate Collection, Groundwater Isolation and Treatment, and ECC Soil Incineration	ALTERNATIVE 9 Access Restrictions With Onsite RCRA Landfill
Technical	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates leachate discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained. Releases from leaking drums or pools of immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Groundwater isolation system provides additional time for further remediation if failure detected. Estimated time of design and construction is 1 to 2 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Public health risk from future site excavation and direct contact, inhalation, and ingestion of VOC's in ECC contaminated soil is reduced to below 10^{-6} cancer risk levels. Potential ADI exceedance for lead and cadmium is unchanged but mitigated by access restrictions and cap. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. ECC soil vapor extraction greatly reduces generation of contaminated leachate. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained. Releases from leaking drums or pools of immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Groundwater isolation system provides additional time for further remediation if failure detected. Installation of cap over ECC would follow the 2 to 4 year operation period of soil vapor extraction. Total estimated time of design and construction is 3 to 6 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Public health risk from future site excavation and direct contact, inhalation, and ingestion of organic contaminants in soil reduced to below 10^{-6} cancer risk levels. Potential ADI exceedance for lead and cadmium is unchanged but mitigated by access restrictions and cap. Effective in protecting public health from direct contact with contaminants by eliminating surface water leachate discharge. Leachate collection and RCRA cap eliminates discharges to surface water. Leachate can still migrate to groundwater, but quantity is reduced by an estimated 90 percent. Groundwater is subsequently collected and treated. ECC soil incineration greatly reduces generation of contaminated leachate. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Groundwater isolation may eventually eliminate risk to public health from direct consumption of groundwater onsite by lowering the water table below zone of contamination. Effective in preventing migration of contaminated groundwater to surface water or offsite. Monitoring results are important to reliable operation of groundwater isolation system. Frequent water level monitoring is necessary to assure low water table is maintained. Releases from leaking drums or pools of immiscible fluids may migrate to the lowered water table and result in continued treatment of groundwater. Failure of collection or treatment system is not likely to pose risk to public health or environment over the short-term at present contaminant levels. If leachate or groundwater contaminant levels increase in future, additional onsite storage volume should be considered. Groundwater isolation system provides additional time for further remediation if failure detected. Installation of cap over ECC would follow the 3 to 4 years implementation period of ECC soil incineration. Total estimated time of design and construction is 4 to 6 years.	Effective in protecting public health from direct contact with contaminants given proper implementation of deed restrictions and maintenance of RCRA cap for an indefinite period. Long-term reliability of deed restriction implementation is unknown. Effective in protecting public health from direct contact with contaminants by eliminating surface leachate discharge. If properly constructed, the onsite RCRA landfill would prevent leachate discharges. Effective in eliminating direct consumption of groundwater given proper implementation of deed restrictions prohibiting installation of wells onsite. Effective in preventing migration of contaminated groundwater to surface water or offsite. Long-term reliability of RCRA landfills has not been demonstrated though is believed to be good given proper maintenance. Monitoring is essential to check the integrity of the landfill liner. Estimated time of design and construction is 3 to 5 years. Potential for exposure of construction workers during excavation is very high.
Public Health and Environment	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation Noise and dust generated by truck traffic during RCRA cap construction. Aquatic habitat improves over time because of cessation of contaminant discharge to Finely Creek.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Aquatic habitat improves over time because of cessation of contamination discharge to Finley Creek. Noise and dust generated by truck traffic during RCRA cap construction.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Aquatic habitat improves over time because of cessation of contaminant discharge to Finley Creek. Noise and dust generated by truck traffic during RCRA cap construction. Release of contaminants to the air or surface water during ECC soil excavation could occur.	Short-term adverse construction effects on aquatic habitat likely due to stream relocation will be mitigated by stream rehabilitation. Aquatic habitat improves over time because of cessation of contaminant discharge to Finely Creek. Releases of contaminants to the air or surface water during landfill excavation could occur. Short-term generation of noise and dust from truck traffic and heavy equipment operation onsite during RCRA landfill construction.
Institutional	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.	All standards will be met. CERCLA goals will be met. Requires delisting of residue to dispose of it onsite. No permits required but need to follow technical requirements.	All standards will be met. CERCLA goal of protection of public health, welfare, and environment is achieved.

COST

Capital	$27,600,000	$28,500,000	$66,400,000	$105,000,000
Annual Average Operation and Maintenance	849,000	896,000	849,000	275,000
Total Present Worth	37,300,000	39,300,000	76,100,000	108,000,000

TABLE 4-1 (Page 2 of 2)
SUMMARY OF DETAILED EVALUATION OF ALTERNATIVES

to contaminated soils, landfill contents, sediment and leachate.

The remedial actions do not address leaching of contaminants to the groundwater or migration of contaminated groundwater to surface water. This alternative relies on monitoring to detect increases in contaminant levels or types in groundwater and surface water. Because groundwater monitoring locations of necessity are located very near surface water discharge areas, there may not be sufficient time for implementation of remedial actions before adverse effects occur if previously undetected contaminants or increased levels of contaminants are detected. Since the potential for increasing contaminant levels or types is great because of the heavily contaminated ECC soils and the reported large quantities of hazardous waste disposed of at NSL, monitoring alone is not considered a reliable means of protecting the public health and environment. Therefore, Alternative 2 is not recommended by EPA.

ALTERNATIVE 3--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

Alternative 3 includes the components of Alternative 2, but with a RCRA cap substituted for the soil cover. The present worth of Alternative 3 is $29,900,000. The cap would reduce leaching of contaminants to the groundwater by an estimated 90 percent and as a result it would reduce the potential for contaminant levels to increase in the future. Migration of groundwater contaminants to surface water, however, would not be mitigated and, as with Alternative 2, protection of public health and environment would be dependent on groundwater and surface water monitoring. As discussed earlier, monitoring alone is not considered reliable. Alternative 3 is not considered to provide adequate protection of public health and the environment and is not recommended by EPA.

ALTERNATIVE 4--ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION AND TREATMENT

Alternative 4 includes the components of Alternative 2 and in addition incorporates groundwater interception and treatment to prevent contaminated groundwater from migrating offsite or discharging to the unnamed ditch or Finley Creek. The present worth cost is $20,800,000.

This alternative is considered effective in protecting public health and the environment from site contamination. The groundwater and leachate collection and treatment systems, however, would be required to operate for a long period of time, possibly in excess of 100 years, because contaminants could continue to leach from soils and landfill contents. Though groundwater collection and treatment has been shown to be reliable, continued maintenance and operation far into the future cannot be assured.

ALTERNATIVE 5--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION AND TREATMENT

Alternative 5 includes the components of Alternative 4, but substitutes a RCRA cap for the soil cover. The present worth of Alternative 5 is $33,900,000. The cap would reduce leaching of contaminants from the unsaturated zone to the groundwater by an estimated 90 percent and, as a result, could reduce the potential for contaminant levels to increase in the future. It is possible that the cap may also reduce the operational period for the groundwater collection and treatment system, though the actual period of operation cannot be reliably estimated.

ALTERNATIVE 6--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT

Alternative 6 includes all the components of Alternative 5 with the exception of the groundwater collection system. The total present worth is $37,300,000. The groundwater isolation system employed in Alternative 6 lowers the groundwater table below the zone believed to be currently contaminated. The intent is to isolate contaminants in the unsaturated zone so they cannot migrate in groundwater. Eventually the groundwater would no longer be contaminated and treatment would not be necessary. This may occur when the water table is fully lowered, estimated to be 5 years. It is possible, however, that contaminants released from buried drums or immiscible fluids could migrate to the lower water table. As a result, the reliability of the groundwater isolation system to reduce the operational period of groundwater treatment is not assured. In addition, the groundwater collection system would have to be operated indefinitely to maintain the lower water table. As with Alternatives 4 and 5, the reliability of long-term maintenance and operation of the collection system is unknown.

The isolation system of Alternative 6 does provide substantially more time between a potential collection system failure and a release of contaminants to surface water. This occurs because of time necessary for the water table to rise onsite and groundwater gradients reverse. Since the time available under Alternatives 4 and 5 is considered substantial, this is not considered a significant benefit.

ALTERNATIVE 7--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL VAPOR EXTRACTION

Alternative 7 includes all components of Alternative 6 and adds soil vapor extraction for ECC-contaminated soil. The present worth is $39,300,000.

The major public health and environmental benefit of soil vapor extraction is the removal of the relatively mobile volatile organic compounds (VOC's) from the soil. This results in a reduced potential for human exposure or overland migration of VOC contaminants offsite in the event of site development. The probability of site development, in violation of deed restrictions, at some point in the future is not known but is believed to be minimal because of the presence of the immediately adjacent NSL site. If site development were to occur, health threats from exposure to other organic and inorganic contaminants would still be present. Removal of VOC's from the unsaturated zone would have little effect on the operational period of the groundwater collection system since these contaminants would be nearly immobilized by the construction of a RCRA cap over the ECC site.

Because a public health threat would remain in the event of future ECC site development and because removal of VOC's from the unsaturated zone is not expected to affect groundwater collection and treatment, the advantages of soil vapor extraction are not considered great. The expenditure of $2,000,000 in present worth for ECC soil vapor extraction for the marginal reduction in health threat is not considered cost effective. Alternative 7 is not recommended by EPA.

ALTERNATIVE 8--ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER ISOLATION AND TREATMENT, AND ECC SOIL INCINERATION

Alternative 8 is similar to Alternative 7 with the exception of ECC soil incineration in place of soil vapor extraction. The present worth of Alternative 8 is $76,100,000. ECC soil incineration would result in the destruction of all organic contaminants in soil in the unsaturated zone with contaminants above the 10^{-6} cancer risk level. The resulting reduction in health threats in the event of future site development would be greater than in Alternative 7. The presence of NSL adjacent to ECC and the restrictions on the deed preventing site development make this unlikely. The present worth of $38,800,000 for ECC soil incineration for reducing public health threats in the unlikely event of future site development is not considered cost effective. Alternative 8 is not recommended by EPA.

ALTERNATIVE 9--ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

Alternative 9 includes deed restrictions; excavation of the landfill contents, peripheral soils, sediments, and ECC-contaminated soil; and disposal of the waste materials in an onsite RCRA type landfill. The present worth is $108,000,000. The new landfill would include a double liner, leachate collection system, leachate and groundwater monitoring system, gas collection system, and multimedia cap.

The new landfill would effectively isolate the contaminants from the environment. Operation and maintenance of the facility would be required indefinitely. Though long-term reliability of the facility is believed to be good, proper operation and maintenance far into the future cannot be assured. Exposure of workers to the hazardous materials may occur during excavation of ECC soils and the landfill. Also inadvertent releases to the environment by volatilization or surface erosion during the several years of construction activity would likely occur. The expenditure of $108,000,000 in present worth is not considered cost effective by EPA when the hazards induced by site excavation are considered and the availability of a lower cost alternative with a similar level of protection for the public health and environment.

COMPARISON OF ALTERNATIVES 4, 5 AND 6

Alternatives 4, 5 and 6 were all found to provide adequate protection of public health, welfare, and environment, if they are operated and maintained through the period of continued contaminant release. Since this period may be in excess of 100 years, an important consideration in alternative selection is to minimize the operation and maintenance necessary, particularly in regards to collection and treatment of contaminated leachate and groundwater. Generally, the less operation and maintenance required the more reliable the system will be in the future.

Alternative 4 requires the greatest amount of treatment for leachate and groundwater since it does not include a RCRA cap. An estimated 40 gpm of leachate and 100 gpm of groundwater may require treatment in excess of 100 years. In comparison to Alternatives 5 and 6, which include a RCRA cap, Alternative 4 would have the poorest long-term reliability for continued effective operation.

Alternatives 5 and 6 both reduce leachate generation to an estimated 5 gpm as a result of the RCRA cap. The groundwater isolation system of Alternative 6 could reduce the need for treatment to leachate only. This could occur as early as 5 years. For the reasons noted earlier, however, this is uncertain and treatment of groundwater may be required indefinitely, as is the case for Alternative 5. In addition, Alternative 6 would require operation and maintenance of the collection system indefinitely, irrespective of whether treatment is necessary.

Comparison of the costs of Alternatives 5 and 6 show Alternative 6 with the following higher costs:

- $2.7 million more in capital cost because of the groundwater isolation system

- $17,000 more in annual operation and maintenance costs (assuming 15 years of groundwater treatment for Alternative 6) as a result of high initial flow rates

- $3.4 million more in present worth

The present worth of Alternative 6 would still be $1.6 million more than Alternative 5 if treatment of groundwater could be terminated after 1 year. Groundwater treatment beyond 15 years would result in even greater cost differences between Alternatives 5 and 6. Because of the greater costs of Alternative 6 and the uncertainty regarding the period treatment of groundwater it is not recommended by EPA.

RECOMMENDED ALTERNATIVE

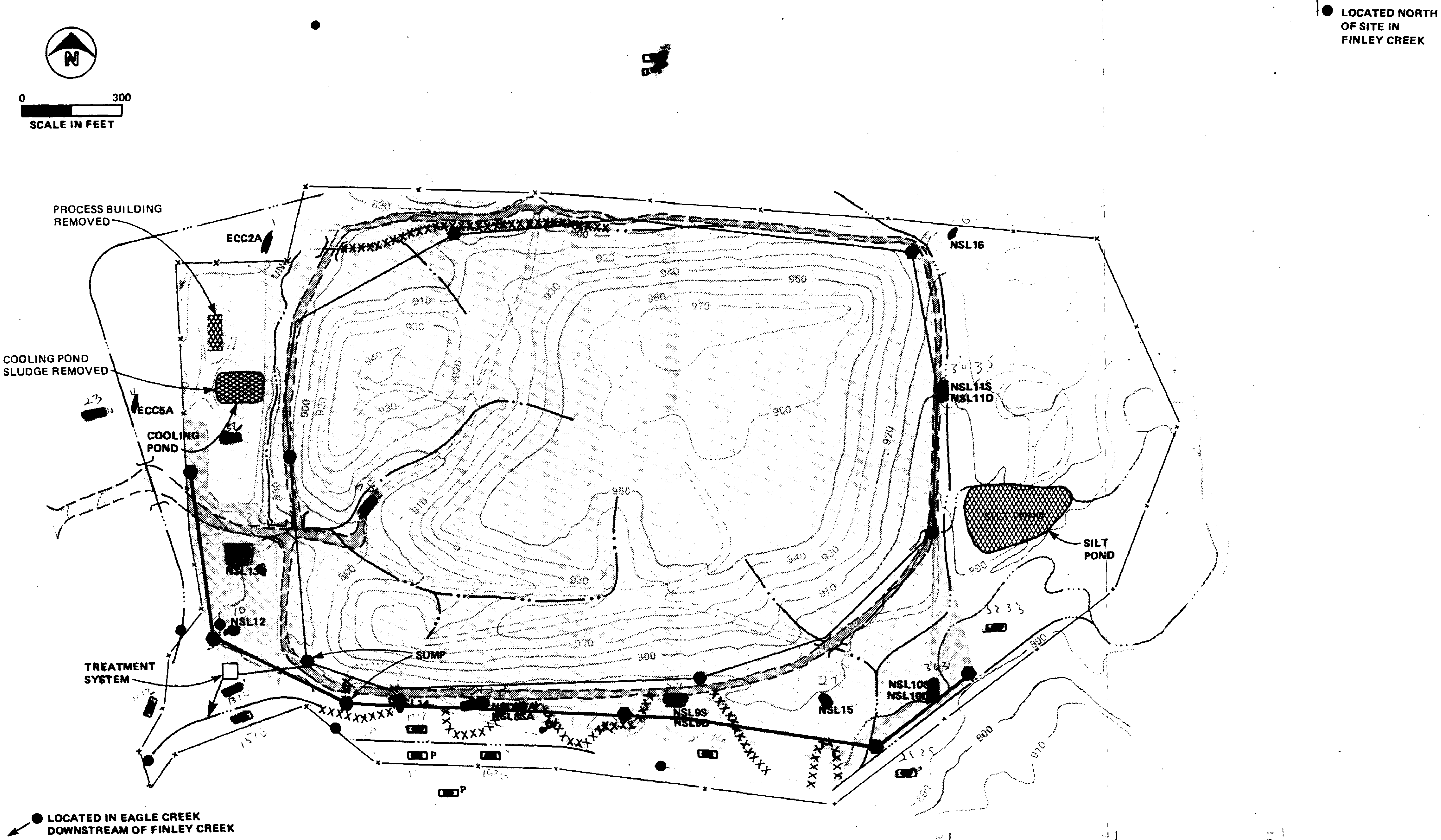
U.S. EPA's recommended alternative is Alternative 5. The major components of the alternative are:

- Access restrictions
- Cooling pond sludge removal
- RCRA cap and surface controls
- Monitoring
- Leachate collection
- Groundwater interception
- Treatment

A site plan and cross sections of Alternative 5 are shown in Figures 4-1, 4-2 and 4-3.

ACCESS RESTRICTIONS

Deed restrictions would be placed on the landfill property and the ECC site. The restrictions should prevent future development of the land to protect against direct contact with contaminants or further migration that could result from site excavation and development. The deed restrictions should also prohibit use of groundwater or installation of wells onsite. Access to the site would be controlled by completing the fencing around the site perimeter and posting signs.



LEGEND

—··—	REROUTED CREEK	P	NEW PIEZOMETER NEST	⬢	MANHOLE	—x—	NEW FENCE
NSL10S NSL10D	EXISTING MONITORING WELL NEST	●D	NEW DEEP WELL	—··—	NEW DITCHES	——	NEW LEACHATE COLLECTION SYSTEM
○ NSL15	EXISTING MONITORING WELL	●	SURFACE WATER/SEDIMENT SAMPLING LOCATION	) (	CULVERT	XXXXXXX	SEDIMENT REMOVAL
	NEW MONITORING WELL NEST	——	GROUNDWATER INTERCEPTION SYSTEM (CONSISTS OF FRENCH DRAINS	==	ROAD IMPROVEMENTS		AREA OF RCRA CAP
				▲	EXTRACTION WELL		

FIGURE 4-1
RECOMMENDED ALTERNATIVE ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION, GROUNDWATER INTERCEPTION, AND TREATMENT
ECC-NSL CAA

[redacted] 12 existing wells

26 new wells

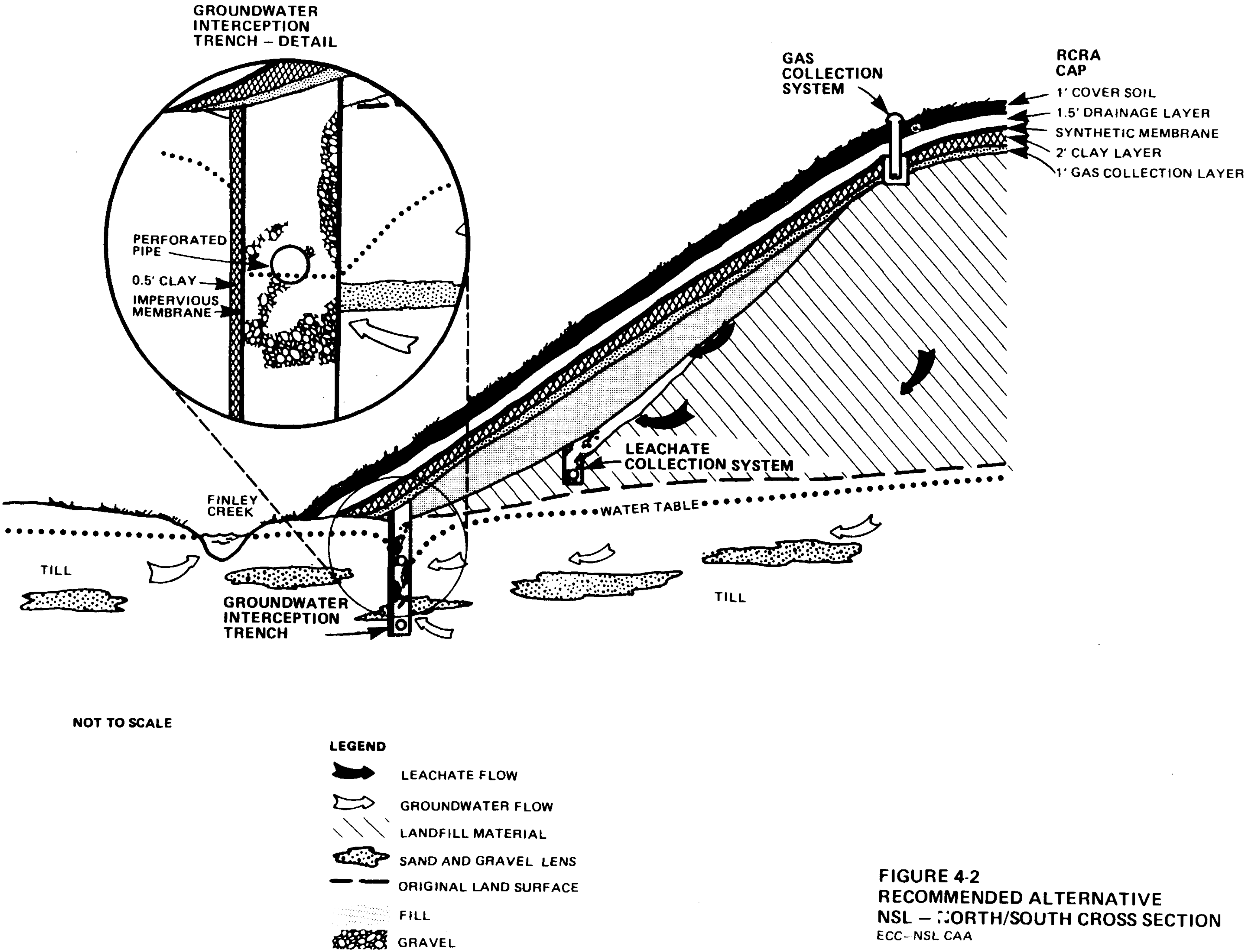
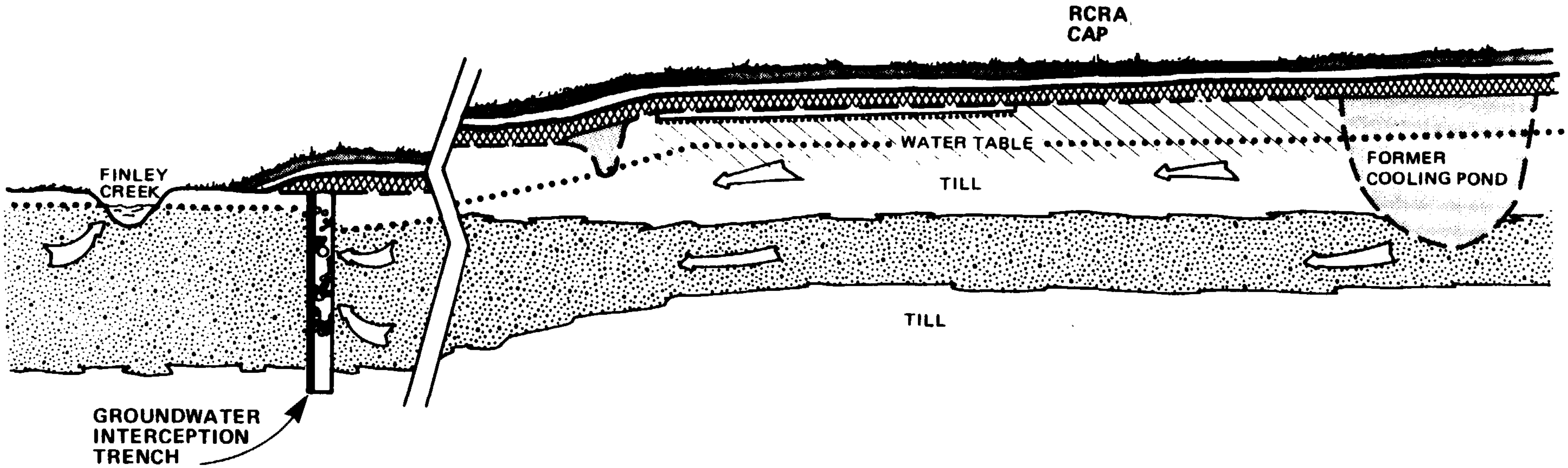


FIGURE 4-2
RECOMMENDED ALTERNATIVE
NSL – NORTH/SOUTH CROSS SECTION
ECC–NSL CAA



LEGEND

- GROUNDWATER FLOW
- SAND AND GRAVEL LENS
- FILL
- CONTAMINATED SOIL
- GRAVEL

NOT TO SCALE

FIGURE 4-3
RECOMMENDED ALTERNATIVE
ECC – NORTH/SOUTH CROSS SECTION
ECC-NSL CAA

COOLING POND SLUDGE REMOVAL

Contaminated sludge or soil remaining in the former ECC cooling pond would be excavated and disposed of at a licensed RCRA landfill. Soil samples would be collected from soil borings in the former cooling pond and analyzed to determine excavation locations and volumes. Excavated sludge or soil would be replaced with clean fill. Removal of the remaining contaminated sludge would reduce contamination of the sand and gravel deposit beneath ECC. Groundwater removed during sludge excavation would be transported and treated at a licensed RCRA facility or treated onsite in the groundwater treatment system.

RCRA CAP AND SURFACE CONTROLS

These actions include removal of contaminated sediment, rerouting of creeks, and construction of a multimedia cap over ECC and NSL.

Contaminated leachate sediment and sediment in the ditch north of NSL and the old creek beds of Finley Creek would be excavated, dewatered, and disposed of onsite beneath the cap. It was assumed for cost estimating that excavation to a 1-foot depth would be necessary and a total of 4,200 cubic yards would be removed. The actual volume removed would be dependent on further sampling undertaken as part of final design. The creek beds would be backfilled and a soil cover would be placed over areas not under the cap. Contaminated water resulting from the dewatering of the sediment would be treated in the onsite treatment system.

The unnamed ditch would be rerouted to the west of ECC and portions of Finley Creek would be rechannelized as shown in Figure 4-1. This would route the surface waters farther away from contaminated areas and increase the time available between contaminant detection in groundwater and discharge to Finley Creek or the unnamed ditch.

The RCRA cap would cover both ECC and NSL and include two low permeability layers. From top to bottom, the cap includes 1 foot of soil for vegetative growth, 1.5 feet of a sand and gravel for drainage, a 30-mil synthetic membrane, 2 feet of clay, and 1 foot of sand (for gas collection on the landfill only). Prior to placing the cap, the site would be graded to eliminate sharp grade changes and to provide for drainage. Also the former process building on the ECC site would be demolished. The concrete floor and foundation would remain and the cap placed on top. The cap would be seeded to control erosion and promote evapotranspiration.

The RCRA cap is expected to reduce the rate of leachate production from 40 gpm to 5 gpm within 5 years. The resulting leachate flowrate requiring treatment would also decrease from 40 gpm to 5 gpm.

MONITORING

Contaminant migration would be assessed through a regular leachate, groundwater, and surface water monitoring program. Leachate would be sampled at the leachate collection sump as part of the leachate collection and treatment system. Groundwater would be monitored during the first year using 15 of the existing wells and an additional 26 new monitoring wells (see Figure 4-1). The 41 monitoring wells would be sampled quarterly the first year and analyzed for the full organic and inorganic priority pollutant list.

Monitoring well sampling would be reduced dependent on results of the four initial sample rounds. It is estimated that subsequent semiannual sampling would be necessary at 14 wells. Samples would be analyzed for VOC's, semivolatiles, and inorganics. Water levels of monitoring wells would be taken at the time of sampling and gradients would be calculated.

Surface water and sediment would be sampled at eight locations semiannually. These samples would be analyzed for VOC's, base/neutrals, pesticides, PCB's, and inorganics. Depending on surface water results, fish may be occasionally collected from Finley and Eagle Creek and their tissues analyzed for bioaccumulation of organic contaminants.

LEACHATE COLLECTION

The leachate collection system would consist of a French drain encircling the landfill. The drain would be about 4 feet deep and about 6,000 feet in length. Perforated pipe laid in the trench would be used to transport leachate to a sump located near the treatment system in the southwest corner of the site. The trench would be backfilled with gravel. A 1-foot layer of gravel would also be placed on the sideslopes of the landfill to provide a drainage path for leachate seepage. The RCRA cap described previously would extend over the gravel layer and the drainage trench. The existing leachate collection system would be decommissioned and abandoned.

GROUNDWATER INTERCEPTION

The objective of the groundwater collection system is to prevent contaminated groundwater from migrating past the perimeter of ECC and the landfill and discharging to surface waters. The collection system costed and described here for this alternative will meet this objective based on the information available to date. Further site investigations during final design may alter the design of the collection system; however, the objective of the groundwater interception system will be met.

The groundwater collection system costed consists of a French drain installed along the southern and southwestern boundaries of the landfill and ECC. The trench would be about an average depth of 25 feet (see Figures 4-1, 4-2, and 4-3). The trench would include two collection pipes, one set 5 feet below the existing water table to function as the interception system, and the other set at the bottom of the trench to be used if the isolation system is implemented at a later time. It is anticipated that an approximate 5-foot overall drawdown of the water table at the collection system would be sufficient to prevent groundwater movement past the system. The French drain would include an impermeable barrier on the south wall of the trench to minimize inflow of water from Finley Creek. The barrier consists of an impermeable synthetic membrane and at least 6 inches of compacted clay. It would extend 3 feet into the till below the sand and gravel deposit in the southwest area of the site. The barrier would also extend 75 feet beyond the western end of the drain.

The initial combined flowrate from the leachate and groundwater collection systems is estimated to be 100 gpm with 40 gpm from the leachate collection system. Within 5 years, the flow is estimated to decrease to about 65 gpm because of a reduction in leachate generation.

TREATMENT

Treatment of leachate and groundwater will be required to meet effluent discharge limits set in the NPDES permit for discharges to Finley Creek. The limits likely applicable are presented in Table 2-4. The limits must protect aquatic life and human health from consumption of aquatic organisms and human health from use of the downstream Eagle Creek Reservoir as a drinking water supply.

The onsite treatment system costed and described here will be capable of meeting the effluent limits. During final design, the treatment system will likely be modified based on pilot and bench-scale testing and more detailed evaluations of capital and operation and maintenance costs. The objective of meeting the discharge limits will be obtained, however.

Leachate and groundwater would be pumped to an onsite treatment plant consisting of precipitation, biological oxidation, and carbon adsorption. The two streams would be combined in a 100,000-gallon holding tank. In the treatment system, the waste stream first passes through the precipitation process for removal of metals and other inorganics. Chromium, copper, iron, lead, and zinc were detected in the groundwater and leachate samples and can be removed by precipitation. Hydroxide precipitation is used for cost estimating purposes. Flocculation and clarification follow the chemical addition and can be accomplished in one basin. Either flocculation with lamella gravity settlers or solids contact clarifiers could be used. Sludge is removed from the bottom of the basin and can be thickened, dewatered with a filter press, and disposed of in a RCRA landfill.

Effluent from the precipitation process then goes through powdered activated carbon treatment (PACT), which is a patented activated carbon enhanced biological treatment system. The PACT system combines biological treatment and carbon adsorption into one process. The system works through the addition of powdered activated carbon to the influent of the activated sludge process. The system consists of carbon feeding equipment, an aeration basin with the necessary appurtenances, a clarifier, and solids handling equipment. Solids would be wasted to an aerobic digester followed by dewatering. Solids would then be disposed of at a RCRA landfill unless they could be delisted as a nonhazardous waste. Spent carbon in the waste solids could be separated and regenerated offsite.

Granular media filtration would be included in the treatment system following either the precipitation system or the PACT system or both. The advantage of having a filter after each unit would be that less metals would carry over into the PACT system and that solids with low settleability would be removed from the biological system effluent. For costing purposes, however, it is assumed that one filter will be used after the PACT system.

OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance would be required for the cap because of erosion, freeze/thaw, and landfill settlement. It was estimated that every fifth year, 10 inches of fill over 50 percent of the landfill would need replacement. Regular mowing of grass on the cap is required. Routine inspections of the cap surface and the leachate and groundwater collection systems would be required semiannually. Replacement of collection system pumps, cleaning of collection system drains, and refurbishment of monitoring well screens would be undertaken as necessary.

The treatment system would require full-time operators to perform testing and maintenance, to adjust chemical and carbon feed rates, and to ensure that all process units are functioning properly. To provide for regular maintenance or in the event of treatment system failure, a 100,000-gallon holding tank is included. This tank provides a 2-day holding time for untreated leachate.

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Appendix A
DETAILED COST TABLES

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTIONS AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. STABILIZE LANDFILL SURFACE						
PRELIMINARY GRADING						TO PREVENT PONDING
CUT	53500	CY	6	321,000		COMMON EARTH, EXCAVATE AND HAUL (SCRAPERS)
FILL						USE ONSITE SOIL (COMMON EARTH), COMPACTED
MATERIAL	178000	CY	6	1,068,000		
PLACEMENT	178000	CY	3	534,000		
RUN-OFF CONTROL						
DITCHING	1760	CY	6	10,560		DITCH 2 FT. WIDE, 3 FT. DEEP, 7020 FT. LONG
RIPRAP	1760	SY	74	130,240		
ESTABLISH VEGETATIVE COVER						
SOIL	119000	CY	5	595,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3207000	SF	0.03	96,210		HYDRAULIC SPREADER
IMPROVE ACCESS ROADS						
COMPACT SUBGRADE	9900	SY	2	19,800		
GEOTEXTILE BASE	9900	SY	2	19,800		12 OZ. TREVIRA
GRAVEL	3300	CY	8	26,400		CRUSHED STONE SUBBASE, 12"
CULVERT BELOW ROADS						
EXCAVATE	34	CY	7	238		DITCH 2 FT. WIDE, 2 FT. DEEP
PIPE	230	LF	11	2,530		12" DIA., BITUM. COATED INVERT
BACKFILL	27	CY	11	297		SAND BACKFILL
PIPE BEDDING	230	LF	2	460		
SUBTOTAL					$2,825,000	
2. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		EXCAVATE SAND & GRAVEL (WET)
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300' HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
3. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
4. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		"
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		"
SUBTOTAL					$81,000	
5. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTIONS AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
SUBTOTAL					$435,000	
6. LEACHATE TREATMENT						DESIGN RATE OF 40 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	37,000	37,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,000	2,000		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	270,000	270,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	48,000	48,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	12,000	12,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					1,426,000	
7. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$5,119,000	
8. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				256,000		
HEALTH AND SAFETY (10 %)				512,000		
BID CONTINGENCIES (15 %)				768,000		
SCOPE CONTINGENCIES (20 %)				1,024,000		
CONSTRUCTION TOTAL					$7,679,000	

04-Nov-86

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTIONS AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
9. OTHER						
PERMITTING (5 %)				384,000		
SERVICES DURING CONSTRUCTION				250,000		
TOTAL IMPLEMENTATION COST					$8,313,000	
10. ENGINEERING						
ENGINEERING DESIGN COST				400,000		
TOTAL CAPITAL COST					$8,713,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. TREATMENT PLANT						REPLACEMENT AT YEAR 15, FLOWRATE OF 40 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	37,000	37,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,200	2,200		STEEL TANK
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	270,000	270,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	48,000	48,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	12,000	12,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
RETROFIT EXPENSES	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$643,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST FIVE YEARS	TOTAL COST AFTER FIVE YEARS	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST 5 YRS., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	90,200	$1100/WELL AFTER 5 YEARS
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 5 YEARS
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 5 YEARS
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 40 GPM						
INFLUENT PUMPING						
ELECTRICITY	13100	kw-h	0.05	655		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	585	TON	45	26,305		ASSUME 30 % SOLIDS
SLUDGE DISPOSAL	585	TON	80	46,800		
CHEMICAL USAGE						
FERROUS SULFATE	58	LB	2.11	123		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	248456	LB	0.05	12,423		
POLYMER USAGE	350	LB	3.35	1,174		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	60000	kw-h	0.05	3,000		
SOLIDS HAULING	177	TON	45	7,965		
SOLIDS DISPOSAL	177	TON	80	14,160		
CARBON USAGE	130000	LB	0.4	52,000		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	65000	kw-h	0.05	3,250		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
3. COLLECTION SYSTEM ($/YEAR)						
PUMP ELECTRICITY	1	LS	1000	1,000		
4. INSPECTION ($/YEAR)						
SITE INSPECTION	1	LS	1800	3,600		1 E1, 1 TECH, 2 DAYS, TWICE PER YEAR
5. OTHER MAINTENANCE ($/YEAR)						
LEACHATE COLLECTION						
PUMP REPLACEMENT	1	LS	500	500		REPLACE EVERY 5 YEARS
REFURBISH WELL SCREENS						
MONITORING WELLS	1	LS	6000	6,000		CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
CAP REPAIRS						
EROSION CONTROL	74	AC	225	16,650		
FREEZE/THAW REPAIRS	74	AC	225	16,650		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					
LEACHATE COLLECTION SYSTEM	5720	LF	0.5	2,860	CLEAN PIPELINE EVERY 5 YEARS

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /lb OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 30): $177,000 /YEAR

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 2: ACCESS RESTRICTIONS WITH SOIL COVER, LEACHATE COLLECTION AND TREATMENT

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$8,713,000			$8,713,000
1		$1,081,000	0.90909	$982,726
2		$1,081,000	0.82645	$893,392
3		$1,081,000	0.75131	$812,166
4		$1,081,000	0.68301	$738,334
5		$1,084,360	0.62092	$673,301
6		$912,000	0.56447	$514,797
7		$912,000	0.51316	$468,002
8		$912,000	0.46651	$425,457
9		$912,000	0.4241	$386,779
10		$921,360	0.38554	$355,221
11		$912,000	0.35049	$319,647
12		$912,000	0.31863	$290,591
13		$912,000	0.28966	$264,170
14		$912,000	0.26333	$240,157
15	$643,000	$915,360	0.23939	$373,056
16		$912,000	0.21763	$198,479
17		$912,000	0.19784	$180,430
18		$912,000	0.17986	$164,032
19		$912,000	0.16351	$149,121
20		$921,360	0.14864	$136,951
21		$912,000	0.13513	$123,239
22		$912,000	0.12285	$112,039
23		$912,000	0.11168	$101,852
24		$912,000	0.10153	$92,595
25		$915,360	0.0923	$84,488
26		$912,000	0.08391	$76,526
27		$912,000	0.07628	$69,567
28		$912,000	0.06934	$63,238
29		$912,000	0.06304	$57,492
30		$921,360	0.05731	$52,803
TOTAL O&M PRESENT WORTH				$9,247,000
TOTAL REPLACEMENT PRESENT WORTH				$154,000
TOTAL PRESENT WORTH				$18,114,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,669,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $133,000

ANNUAL O & M COSTS:

ANNUAL COSTS	FIRST FIVE YEARS	AFTER FIVE YEARS
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	90,200
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$178,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	3,600
MOWING	49,580
COLLECTION SYSTEM	
PUMP ELECTRICITY	1,000
TOTAL ANNUAL COSTS ($/YEAR)	$185,000

NONANNUAL MAINTENANCE ($/ACTIVITY)	
MONITORING WELLS	
REFURBISH SCREENS (EVERY 10 YEARS)	$6,000
LEACHATE COLLECTION SYSTEM	
PUMP REPLACEMENT (EVERY 5 YEARS)	$500
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION	$2,860

TREATMENT PLANT OPERATION ($/YR)	
TREATMENT SYSTEM FLOWRATE @ 40 GPM	
INFLUENT PUMPING	
ELECTRICITY	655
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	26,305
SLUDGE DISPOSAL	46,800
CHEMICAL USAGE	
FERROUS SULFATE	123
ALKALI	12,423
POLYMER	1,174
PACT SYSTEM	
ELECTRICITY	3,000
SOLIDS HAULING	7,965
SOLIDS DISPOSAL	14,160
CARBON USAGE	52,000
AIR COMPRESSOR	
ELECTRICITY	3,250
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
TOTAL ANNUAL OPERATING COST	$549,000

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 3: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300' HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
2. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
3. ECC SITE WORK						
REMOVE PROCESS BUILDING						
BUILDING REMOVAL	108750	CF	0.2	21,750		SINGLE BLDG, NO SALVAGE
HAUL TO DISPOSAL	225	CY	4.4	990		12 CY TRUCK, 0.5 MI R.T.
REMOVE CONTAMINATED SLUDGE/SOIL						
TESTING PRIOR TO EXCAVATION	1	LS	14000	14,000		
EXCAVATE	1825	CY	3.4	6,205		BACKHOE EXCAV, & DOUBLED FOR H&S
TRUCK LINERS	37	EA	200	7,400		
HAUL OFFSITE	730	CY	43	31,390		225 MI HAUL, 730 CY
DISPOSAL @ RCRA FACILITY	730	CY	80	58,400		
REMOVE EXTRACTED CONTAMINATED GROUNDWA						
HAUL OFFSITE	9000	GAL	0.24	2,160		$450/TRUCK, $3.25/MILE, 225 MILES TO FACILITY
TREATMENT @ RCRA FACILITY	9000	GAL	0.24	2,160		TRUCK HANDLING AND TREATMENT
SUBTOTAL					$144,000	
4. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		
SUBTOTAL					$81,000	
5. RCRA CAP CONSTRUCTION						
PRELIMINARY GRADING						
FILL - EXCAVATE & HAUL	213100	CY	6	1,278,600		USE ONSITE SOIL (COMMON EARTH)
FILL - BACKFILL	213100	CY	3	639,300		
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	238000	CY	10	2,380,000		
BACKFILL	238000	CY	3	714,000		
GEOTEXTILE	713000	SY	1.5	1,069,500		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	356000	SY	1.8	640,800		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	178000	CY	8	1,424,000		
BACKFILL	178000	CY	3	534,000		
ESTABLISH VEGETATIVE COVER						

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 3: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
TOPSOIL	119000	CY	5	595,000		ONSITE TILL, EXCAVATE, HAUL, AND BACKFILL
HYDROSEED	3207000	SF	0.03	96,210		FESCUE, HYDRAULIC SPREADER
SUBTOTAL					$10,614,000	
6. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP
SUBTOTAL					$435,000	
7. LEACHATE TREATMENT						DESIGN RATE OF 40 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	37,000	37,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,000	2,000		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	270,000	270,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	48,000	48,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	12,000	12,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					1,426,000	
8. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 3: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$13,052,000	
9. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				653,000		
HEALTH AND SAFETY (10 %)				1,305,000		
BID CONTINGENCIES (15 %)				1,958,000		
SCOPE CONTINGENCIES (20 %)				2,610,000		
CONSTRUCTION TOTAL					$19,578,000	
10. OTHER						
PERMITTING (5 %)				979,000		
SERVICES DURING CONSTRUCTION				400,000		
TOTAL IMPLEMENTATION COST					$20,957,000	
11. ENGINEERING						
ENGINEERING DESIGN COST				450,000		
TOTAL CAPITAL COST					$21,407,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 3: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. TREATMENT PLANT						REPLACEMENT AT YEAR 5, RE-USE MOST EQUIPMENT
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	18,000	18,000		AVERAGE PRICE OF TWO SYSTEMS
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	124,000	124,000		MODEL 55-A
STARTUP	4	DAY	500	2,000		
RETROFIT EXPENSES,	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$167,000	
2. TREATMENT PLANT						REPLACEMENT AT YEAR 20, FLOWRATE OF 5 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	18,000	18,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	1,800	1,800		STEEL TANK
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	124,000	124,000		MODEL 55-A
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	23,000	23,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	5,000	5,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
RETROFIT EXPENSES	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$399,000	
3. RCRA CAP REPLACEMENT						REPLACEMENT AT 30 YEARS
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	238000	CY	10	2,380,000		
BACKFILL	238000	CY	3	714,000		
GEOTEXTILE	713000	SY	1.5	1,069,500		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	356000	SY	1.8	640,800		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	178000	CY	8	1,424,000		
BACKFILL	178000	CY	3	534,000		
ESTABLISH VEGETATIVE COVER						
TOPSOIL	119000	CY	5	595,000		ONSITE TILL, EXCAVATE, HAUL, AND BACKFILL
HYDROSEED	3207000	SF	0.03	96,210		FESCUE, HYDRAULIC SPREADER
SUBTOTAL (TO NEAREST $1000)					$8,697,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 3: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST FIVE YEARS	TOTAL COST AFTER FIVE YEARS	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST 5 YRS., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
NEW MONITORING WELLS	41	EA	1400	229,600	90,200	$1100/WELL AFTER 5 YEARS
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 5 YEARS
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 5 YEARS
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 40 GPM - - FIRST 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	13100	kw-h	0.05	655		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	585	TON	45	26,305		
SLUDGE DISPOSAL	585	TON	80	46,800		
CHEMICAL USAGE						
FERROUS SULFATE	58	LB	2.11	123		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	248226	LB	0.05	12,411		
POLYMER USAGE	350	LB	3.35	1,174		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	60000	kw-h	0.05	3,000		
SOLIDS HAULING	177	TON	45	7,965		
SOLIDS DISPOSAL	177	TON	80	14,160		
CARBON USAGE	130000	LB	0.4	52,000		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	65000	kw-h	0.05	3,250		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 5 GPM - - AFTER 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	3270	kw-h	0.05	164		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	68	TON	45	3,055		
SLUDGE DISPOSAL	68	TON	80	5,440		
CHEMICAL USAGE						
FERROUS SULFATE	7	LB	2.11	15		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	31029	LB	0.05	1,551		
POLYMER USAGE	44	LB	3.35	147		2 PPM PERCOL 776

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	26000	kw-h	0.05	1,300	
SOLIDS HAULING	22	TON	45	990	
SOLIDS DISPOSAL	22	TON	80	1,760	
CARBON USAGE	16425	LB	0.4	6,570	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	33000	kw-h	0.05	1,650	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
3. COLLECTION SYSTEM ($/YEAR)					
PUMP ELECTRICITY	1	LS	1000	1,000	
4. INSPECTION ($/YEAR)					
SITE INSPECTION	1	LS	1800	3,600	1 EI, 1 TECH, 3 DAYS, TWICE PER YEAR
5. OTHER MAINTENANCE ($/YEAR)					
LEACHATE COLLECTION					
PUMP REPLACEMENT	1	LS	500	500	REPLACE PUMP EVERY 3 YEARS
REFURBISH WELL SCREENS					
MONITORING WELLS	1	LS	6000	6,000	CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
CAP REPAIRS					
EROSION CONTROL	74	AC	225	16,650	
FREEZE/THAW REPAIRS	74	AC	225	16,650	
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					
LEACHATE COLLECTION SYSTEM	5720	LF	0.5	2,860	CLEAN PIPELINE EVERY 5 YEARS

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. *PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION*
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /lb OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 5): $177,000 /YEAR
   COST (YEARS 1 TO 5): $22,000

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 3: ACCESS RESTRICTIONS WITH RCRA CAP, LEACHATE COLLECTION AND TREATMENT

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$20,827,000			$20,827,000
1		$1,081,000	0.90909	$982,726
2		$1,081,000	0.82645	$893,392
3		$1,081,000	0.75131	$812,166
4		$1,081,000	0.68301	$738,334
5	$167,000	$1,084,360	0.62092	$776,994
6		$766,000	0.56447	$432,384
7		$766,000	0.51316	$393,081
8		$766,000	0.46651	$357,347
9		$766,000	0.4241	$324,861
10		$775,360	0.38554	$298,932
11		$766,000	0.35049	$268,475
12		$766,000	0.31863	$244,071
13		$766,000	0.28966	$221,880
14		$766,000	0.26333	$201,711
15		$769,360	0.23939	$184,177
16		$766,000	0.21763	$166,705
17		$766,000	0.19784	$151,545
18		$766,000	0.17986	$137,773
19		$766,000	0.16351	$125,249
20	$399,000	$775,360	0.14864	$174,557
21		$766,000	0.13513	$103,510
22		$766,000	0.12285	$94,103
23		$766,000	0.11168	$85,547
24		$766,000	0.10153	$77,772
25		$769,360	0.0923	$71,012
26		$766,000	0.08391	$64,275
27		$766,000	0.07628	$58,430
28		$766,000	0.06934	$53,114
29		$766,000	0.06304	$48,289
30	$8,328,000	$775,360	0.05731	$521,714

TOTAL O&M PRESENT WORTH	$8,424,000
TOTAL REPLACEMENT PRESENT WORTH	$640,000
TOTAL PRESENT WORTH	$29,891,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $795,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $64,000

ANNUAL COSTS	FIRST FIVE YEARS	AFTER FIVE YEARS
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	90,200
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$178,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	3,600
MOWING	49,580
COLLECTION SYSTEM	
PUMP ELECTRICITY	1,000
TOTAL ANNUAL COSTS ($/YEAR)	$185,000

NONANNUAL MAINTENANCE ($/ACTIVITY)	
MONITORING WELLS	
REFURBISH SCREENS (EVERY 10 YEARS)	$6,000
LEACHATE COLLECTION SYSTEM	
PUMP REPLACEMENT (EVERY 5 YEARS)	$500
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION SYSTEM	$2,860

TREATMENT SYSTEM FLOW RATE @ 40 GPM - FIRST 5 YEARS	
INFLUENT PUMPING	
ELECTRICITY	655
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	26,305
SLUDGE DISPOSAL	46,800
CHEMICAL USAGE	
FERROUS SULFATE	123
ALKALI	12,411
POLYMER	1,174
PACT SYSTEM	
ELECTRICITY	3,000
SOLIDS HAULING	7,965
SOLIDS DISPOSAL	14,160
CARBON USAGE	53,000
AIR COMPRESSOR	
ELECTRICITY	3,250
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$549,000

TREATMENT SYSTEM FLOW RATE @ 5 GPM - AFTER 5 YEARS	
INFLUENT PUMPING	
ELECTRICITY	164
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	3,055
SLUDGE DISPOSAL	5,440
CHEMICAL USAGE	
FERROUS SULFATE	15
ALKALI	1,551
POLYMER	147
PACT SYSTEM	
ELECTRICITY	1,300
SOLIDS HAULING	990
SOLIDS DISPOSAL	1,760
CARBON USAGE	6,570
AIR COMPRESSOR	
ELECTRICITY	1,650
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$403,000

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. STABILIZE LANDFILL SURFACE						
PRELIMINARY GRADING						TO PREVENT PONDING
CUT	53500	CY	6	321,000		COMMON EARTH, EXCAVATE AND HAUL
FILL						USE ONSITE SOIL (COMMON EARTH), COMPACTED
EXCAVATE & HAUL	178000	CY	6	1,068,000		
BACKFILL	178000	CY	3	534,000		
RUN-OFF CONTROL						
DITCHING	1760	CY	6	10,560		DITCH 2 FT. WIDE, 3 FT. DEEP, 7000 FT. LONG
RIPRAP	1760	SY	74	130,240		
ESTABLISH VEGETATIVE COVER						
SOIL	119000	CY	5	595,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3207000	SF	0.03	96,210		HYDRAULIC SPREADER
IMPROVE ACCESS ROADS						
COMPACT SUBGRADE	9900	SY	2	19,800		
GEOTEXTILE BASE	9900	SY	2	19,800		12 OZ. TREVIRA
GRAVEL	3300	CY	8	26,400		CRUSHED STONE SUBBASE, 12"
CULVERT BELOW ROADS						
EXCAVATE	34	CY	7	238		DITCH 2 FT. WIDE, 2 FT. DEEP
PIPE	230	LF	11	2,530		12" DIA., BITUM. COATED INVERT
BACKFILL	27	CY	11	297		SAND BACKFILL
PIPE BEDDING	230	LF	2	460		
SUBTOTAL					$2,825,000	
2. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		EXCAVATE SAND & GRAVEL (WET)
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300' HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGATATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
3. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
4. ECC SITE WORK						
REMOVE PROCESS BUILDING						
BUILDING REMOVAL	108750	CF	0.2	21,750		SINGLE BLDG, NO SALVAGE
FOUNDATION DEMOLITION	3625	SF	3.3	11,963		CONCRETE SLAB, REINFORCED 1 FOOT THICK
DISPOSAL	360	CY	3.7	1,332		DEMOLISHED BUILDING VOLUME AND FDN. VOLUME
REMOVE CONCRETE PAD						
DEMOLITION	30500	SF	3	91,500		DEMOLISH CONCRETE PAD
DISPOSAL	850	CY	3.7	3,145		ASSUME 0.75 FEET THICK
REMOVE CONTAMINATED SLUDGE/SOIL						
TESTING PRIOR TO EXCAVATION	1	LS	14000	14,000		
EXCAVATE	1825	CY	3.4	6,205		BACKHOE EXCAV. & DOUBLED FOR H&S
TRUCK LINERS	37	EA	200	7,400		
HAUL OFFSITE	730	CY	43	31,390		225 MI HAUL, 730 CY
DISPOSAL @ RCRA FACILITY	730	CY	80	58,400		
REMOVE EXTRACTED CONTAMINATED GROUNDWATER						
HAUL OFFSITE	9000	GAL	0.24	2,160		$450/TRUCK, $3.25/MILE, 225 MILES TO FACILITY
TREATMENT @ RCRA FACILITY	9000	GAL	0.24	2,160		TRUCK HANDLING AND TREATMENT
SUBTOTAL					$251,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
5. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		
SUBTOTAL					$81,000	
6. GROUNDWATER INTERCEPTION AND COLLECTION						
EXTRACTION WELLS	160	LF	60	9,600		8" DIA. WELLS, AIR ROTARY DRILLED
PUMPS	6	EA	265	1,590		
COLLECTION PIPE	760	LF	4	3,040		4" DIA. METAL
CONNECTIONS						
TEES	6	EA	205	1,230		4" TEE, CORROSION RESISTANT
BENDS	6	EA	120	720		1/4 BEND, 4" DIA.
TRENCH FOR PIPE	225	CY	5	1,125		800 FT. LONG, 4 FT. WIDE, 2 FT. DEEP
WIRING						
CONDUIT	1000	LF	4	4,000		1.5" DIA. CONDUIT
RECEPTACLES	17	EA	15	255		120 V., 15 AMP, GROUNDED
WIRE	6000	LF	2	12,000		#0 SIZE WIRE
FRENCH DRAINS						
SHORING AND BRACING	26400	SF	1.4	36,960		WOOD SHEETING, WALES, BRACES, 12 FT X 4 FT X 2200 FT
DEWATERING	4	EA	440	1,760		SUMP PUMPS
EXCAVATE TRENCH	3910	CY	4	15,640		DOUBLED FOR HEALTH AND SAFETY
LINE TRENCH						
IMPERVIOUS MEMBRANE	26400	SF	0.2	5,280		
PERVIOUS GEOTEXTILE	35200	SF	0.17	5,984		
PERFORATED PIPE	2200	LF	6	13,200		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	3910	CY	15	58,650		GRAVEL FILL, COMPACTED
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	3	EA	895	2,685		PRECAST CONC., 4' ID, 12' DEEP
SUBTOTAL					$178,000	
7. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP
SUBTOTAL					$435,000	
8. GROUNDWATER COLLECTION - ECC						
FRENCH DRAINS						
SOIL BORING PRIOR TO EXCAVATION	1	LS	36000	36,000		46 BORINGS ON 50 FT CENTERS
SHORING AND BRACING	92000	SF	2	184,000		TRENCH - 17' DEEP, 4' WIDE, 5400' LONG (TOTAL). WOOD SH
DEWATERING	4	EA	440	1,760		SUMP PUMPS
EXCAVATE TRENCH	13600	CY	4	54,400		
PERVIOUS GEOTEXTILE	205200	SF	0.17	34,884		
PERFORATED PIPE	4700	LF	4	18,800		METAL, 4" DIA.
GRAVEL BACKFILL	13600	CY	15	204,000		GRAVEL BACKFILL, COMPACTED
COLLECTOR & RISER PIPE	1000	LF	4	4,000		METAL, 4" DIA.
CONNECTIONS	18	EA	39	702		(TOTAL #)
WET WELL	1	EA	2300	2,300		PRECAST CONC., MANHOLE, 6' ID, 16' DEEP
SUMP PUMP	1	EA	2100	2,100		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
SUBTOTAL					$507,000	
9. GROUNDWATER/LEACHATE TREATMENT						DESIGN RATE OF 138 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	87,000	87,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,000	2,000		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	585,000	585,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	55,000	55,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					$1,803,000	
10. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$6,432,000	
11. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				322,000		
HEALTH AND SAFETY (15 %)				965,000		
BID CONTINGENCIES (15 %)				965,000		
SCOPE CONTINGENCIES (20 %)				1,286,000		
CONSTRUCTION TOTAL					$9,970,000	
12. OTHER						

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
PERMITTING (5 %)				499,000		
SERVICES DURING CONSTRUCTION				250,000		
TOTAL IMPLEMENTATION COST					$10,719,000	
13. ENGINEERING						
ENGINEERING DESIGN COST				500,000		
TOTAL CAPITAL COST					$11,219,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION AND LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. TREATMENT PLANT						REPLACEMENT AT YEAR 15, FLOWRATE OF 138 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	87,000	87,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,200	2,200		STEEL TANK
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	585,000	585,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	55,000	55,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
RETROFIT EXPENSES	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$1,020,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST YEAR	TOTAL COST AFTER FIRST YEAR	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST YR., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	30,800	$1400/QTR FIRST YEAR, THEN $1100/SEMI-ANN FOR 14 WELLS
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY, SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY, SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 138 GPM						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	1019	TON	45	45,855		ASSUME 30 % SOLIDS
SLUDGE DISPOSAL	1019	TON	80	81,520		
CHEMICAL USAGE						
FERROUS SULFATE	117	LB	2.11	246		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	439394	LB	0.05	21,970		
POLYMER USAGE	1208	LB	3.35	4,047		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	770000	kw-h	0.05	38,500		
SOLIDS HAULING	204	TON	45	9,180		
SOLIDS DISPOSAL	204	TON	80	16,320		
CARBON USAGE	139795	LB	0.4	55,918		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
3. PUMP ELECTRICITY ($/YEAR)						
GROUNDWATER INTERCEPTION SYSTEM	1	LS	2000	2,000		
GROUNDWATER COLLECTION SYSTEM-ECC	1	LS	650	650		
LEACHATE COLLECTION SYSTEM	1	LS	1000	1,000		
4. INSPECTION ($/YEAR)						QUARTERLY FOR 1ST 5 YRS., SEMI-ANNUALLY THEREAFTER
SITE INSPECTION	1	LS	1800	3,600		1 E1, 1 TECH, 2 DAYS, TWICE PER YEAR
5. OTHER MAINTENANCE ($/YEAR)						
GROUNDWATER/LEACHATE COLLECTION						
EXTRACTION WELL PUMP REPLACEMENT	7	EA	265	1,855		REPLACE ALL PUMPS EVERY 3 YEARS
FRENCH DRAIN PUMP REPLACEMENT	1	EA	1000	1,000		REPLACE EVERY 5 YEARS
LEACHATE COLLECTION PUMP REPLACEMENT	1	EA	500	500		REPLACE EVERY 5 YEARS
GROUNDWATER COLLECTION PUMP-ECC	1	EA	2100	2,100		REPLACE EVERY 5 YEARS
REFURBISH WELL SCREENS						

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
MONITORING WELLS	1	LS	6000	6,000	CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
COLLECTION SYSTEM WELLS	1	LS	2000	2,000	CLEAN EVERY 10 YRS. - 1 WK. LABOR, 2 PEOPLE
CAP REPAIRS					
EROSION CONTROL	74	AC	225	16,650	
FREEZE/THAW REPAIRS	74	AC	225	16,650	
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					CLEAN PIPELINE EVERY 5 YEARS
LEACHATE COLLECTION SYSTEM	5720	LF	0.5	2,860	
GROUNDWATER INTERCEPTION SYSTEM	2200	LF	0.5	1,100	
GROUNDWATER COLLECTION SYSTEM-ECC	5400	LF	0.5	2,700	

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /lb OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 30): $204,000 /YEAR

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 4: ACCESS RESTRICTIONS WITH SOIL COVER, GROUNDWATER INTERCEPTION/COLLECTION AND LEACHATE COLLECTION AND TREATMENT

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$11,219,000			$11,219,000
1		$1,199,000	0.90909	$1,089,999
2		$970,000	0.82645	$801,657
3		$971,855	0.75131	$730,164
4		$970,000	0.68301	$662,520
5		$980,260	0.62092	$608,663
6		$971,855	0.56447	$548,583
7		$970,000	0.51316	$497,765
8		$970,000	0.46651	$452,515
9		$971,855	0.4241	$412,164
10		$988,260	0.38554	$381,014
11		$970,000	0.35049	$339,975
12		$971,855	0.31863	$309,662
13		$970,000	0.28966	$280,970
14		$970,000	0.26333	$255,430
15	$1,020,000	$982,115	0.23939	$479,286
16		$970,000	0.21763	$211,101
17		$970,000	0.19784	$191,905
18		$971,855	0.17986	$174,798
19		$970,000	0.16351	$158,605
20		$988,260	0.14864	$146,895
21		$971,855	0.13513	$131,327
22		$970,000	0.12285	$119,165
23		$970,000	0.11168	$108,330
24		$971,855	0.10153	$98,672
25		$980,260	0.0923	$90,478
26		$970,000	0.08391	$81,393
27		$971,855	0.07628	$74,133
28		$970,000	0.06934	$67,260
29		$970,000	0.06304	$61,149
30		$990,115	0.05731	$56,743

TOTAL O&M PRESENT WORTH	$9,378,000
TOTAL REPLACEMENT PRESENT WORTH	$244,000
TOTAL PRESENT WORTH	$20,841,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,923,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $154,000

ANNUAL O & M COSTS:

ANNUAL COSTS	FIRST YEAR	AFTER FIRST YEAR
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	30,800
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$118,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	3,600
MOWING	49,580
PUMP ELECTRICITY	
GROUNDWATER INTERCEPTION	2,000
GROUNDWATER COLLECTION - ECC	650
LEACHATE COLLECTION	1,000
TOTAL ANNUAL COSTS ($/YEAR)	$188,000

NONANNUAL MAINTENANCE ($/ACTIVITY)	
REFURBISH SCREENS (EVERY 10 YEARS)	
MONITORING WELLS	$6,000
GROUNDWATER INTERCEPTION SYSTEM	$2,000
GROUNDWATER/LEACHATE COLLECTION PUMP REPLACEMENT	
EXTRACTION WELL (EVERY 3 YEARS)	$1,855
FRENCH DRAIN (EVERY 5 YEARS)	$1,000
LEACHATE COLLECTION (EVERY 5 YEARS)	$500
GROUNDWATER COLLECT-ECC (EVERY 5 YRS)	$2,100
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION SYSTEM	$2,860
GROUNDWATER INTERCEPTION SYSTEM	$1,100
GROUNDWATER COLLECTION - ECC	$2,700

TREATMENT PLANT OPERATION ($/YR)	
TREATMENT SYSTEM FLOW RATE @ 138 GPM	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	45,855
SLUDGE DISPOSAL	81,520
CHEMICAL USAGE	
FERROUS SULFATE	246
ALKALI	21,970
POLYMER	4,047
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	9,180
SOLIDS DISPOSAL	16,320
CARBON USAGE	55,918
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
TOTAL ANNUAL OPERATING COST	$664,000

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300' HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
2. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
3. ECC SITE WORK						
REMOVE PROCESS BUILDING						
BUILDING REMOVAL	108750	CF	0.2	21,750		SINGLE BLDG, NO SALVAGE
FOUNDATION DEMOLITION	3625	SF	3.3	11,963		CONCRETE SLAB, REINFORCED 1 FOOT THICK
DISPOSAL	360	CY	3.7	1,332		DEMOLISHED BUILDING VOLUME AND FDN. VOLUME
REMOVE CONCRETE PAD						
DEMOLITION	30500	SF	3	91,500		DEMOLISH CONCRETE PAD
DISPOSAL	850	CY	3.7	3,145		ASSUME 0.75 FEET THICK
REMOVE CONTAMINATED SLUDGE/SOIL						
TESTING PRIOR TO EXCAVATION	1	LS	14000	14,000		
EXCAVATE	1825	CY	3.4	6,205		BACKHOE EXCAV, & DOUBLED FOR H&S
TRUCK LINERS	37	EA	200	7,400		
HAUL OFFSITE	730	CY	43	31,390		225 MI HAUL, 730 CY
DISPOSAL @ RCRA FACILITY	730	CY	80	58,400		
REMOVE EXTRACTED CONTAMINATED GROUNDWA						
HAUL OFFSITE	9000	GAL	0.24	2,160		$450/TRUCK, $3.25/MILE, 225 MILES TO FACILITY
TREATMENT @ RCRA FACILITY	9000	GAL	0.24	2,160		TRUCK HANDLING AND TREATMENT
SUBTOTAL					$251,000	
4. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		"
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		"
SUBTOTAL					$81,000	
5. RCRA CAP CONSTRUCTION						
PRELIMINARY GRADING						
FILL - EXCAVATE & HAUL	213100	CY	6	1,278,600		USE ONSITE SOIL (COMMON EARTH)
FILL - BACKFILL	213100	CY	3	639,300		
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		1 FT. THICK, IMPORTED SOIL
HYDROSEED	3329000	SF	0.03	99,870		FESCUE, HYDRAULIC SPREADER
SUBTOTAL					$10,903,000	
6. GROUNDWATER INTERCEPTION AND COLLECTION						
FRENCH DRAINS						
SHORING AND BRACING	62000	SF	2	124,000		WOOD SHEETING, WALES, BRACES, 12 FT X 4 FT X 2200 FT
DEWATERING	4	EA	605	2,420		SUMP PUMPS
EXCAVATE TRENCH	9200	CY	4	36,800		
LINE TRENCH						
IMPERVIOUS MEMBRANE	62000	SF	0.2	12,400		
PERVIOUS GEOTEXTILE	75000	SF	0.17	12,750		
CLAY WALL LINER						
EXCAVATE AND HAUL	450	CY	10	4,500		
BACKFILL	450	CY	3	1,350		
PERFORATED PIPE	6100	LF	6	36,600		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	9200	CY	15	138,000		GRAVEL FILL, COMPACTED
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	1902	9,510		PRECAST CONC., 4' ID, 25' DEEP
SUBTOTAL					$383,000	
7. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP
SUBTOTAL					$435,000	
8. GROUNDWATER/LEACHATE TREATMENT						DESIGN RATE OF 101 GPM, DROPS TO 66 GPM AFTER 5 YEARS. EQUIPMENT SIZE REMAINS THE SAME.
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	87,000	87,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,200	2,200		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	585,000	585,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	55,000	55,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					$1,803,000	
9. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$14,208,000	
10. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				710,000		
HEALTH AND SAFETY (15 %)				2,131,000		
BID CONTINGENCIES (15 %)				2,131,000		
SCOPE CONTINGENCIES (25 %)				3,552,000		
CONSTRUCTION TOTAL					$22,732,000	
11. OTHER						
PERMITTING (5 %)				1,137,000		
SERVICES DURING CONSTRUCTION				450,000		
TOTAL IMPLEMENTATION COST					$24,319,000	
12. ENGINEERING						
ENGINEERING DESIGN COST				550,000		
TOTAL CAPITAL COST					$24,869,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION AND LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. TREATMENT PLANT						REPLACEMENT AT YEAR 15, FLOW DROPS TO 66 GPM AFTER 5 YEARS.
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	87,000	87,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	2,200	2,200		STEEL TANK
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	585,000	585,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	55,000	55,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
RETROFIT EXPENSES	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$1,020,000	
2. RCRA CAP REPLACEMENT						REPLACEMENT AT 30 YEARS
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870		HYDRAULIC SPREADER
SUBTOTAL (TO NEAREST $1000)					$8,985,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION/COLECTION, LEACHATE COLLECTION AND TREA

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST YEAR	TOTAL COST AFTER FIRST YEAR	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST YR., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	30,800	14 WELLS AFTER FIRST YEAR, $1100/WELL
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 101 GPM - - FIRST 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	861	TON	45	38,745		
SLUDGE DISPOSAL	861	TON	80	68,880		
CHEMICAL USAGE						
FERROUS SULFATE	80	LB	2.11	169		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	369800	LB	0.05	18,490		
POLYMER USAGE	879	LB	3.35	2,945		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	770000	kw-h	0.05	38,500		
SOLIDS HAULING	193	TON	45	8,685		
SOLIDS DISPOSAL	193	TON	80	15,440		
CARBON USAGE	136000	LB	0.4	54,400		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 66 GPM - - AFTER 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	333	TON	45	14,985		
SLUDGE DISPOSAL	333	TON	80	26,640		
CHEMICAL USAGE						
FERROUS SULFATE	33	LB	2.11	70		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	148300	LB	0.05	7,415		
POLYMER USAGE	573	LB	3.35	1,920		2 PPM PERCOL 776

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION/COLECTION, LEACHATE COLLECTION AND TREA

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	770000	kw-h	0.05	38,500	
SOLIDS HAULING	40	TON	45	1,800	
SOLIDS DISPOSAL	40	TON	80	3,200	
CARBON USAGE	23000	LB	0.4	9,200	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
3. PUMP ELECTRICITY ($/YEAR)					
GROUNDWATER INTERCEPTION SYSTEM	1	LS	2000	2,000	
LEACHATE COLLECION SYSTEM	1	LS	1000	1,000	
4. INSPECTION ($/YEAR)					
SITE INSPECTION	1	LS	1800	3,600	1 E1, 1 TECH, 3 DAYS, TWICE PER YEAR
5. OTHER MAINTENANCE ($/YEAR)					
GROUNDWATER/LEACHATE COLLECTION					
FRENCH DRAIN PUMP REPLACEMENT	1	EA	1000	1,000	REPLACE EVERY 5 YEARS
LEACHATE COLLECTION PUMP REPLACEMENT	1	EA	500	500	REPLACE EVERY 5 YEARS
REFURBISH WELL SCREENS					
MONITORING WELLS	1	LS	6000	6,000	CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
COLLECTION SYSTEM WELLS	1	LS	2000	2,000	CLEAN EVERY 10 YRS. - 1 WK. LABOR, 2 PEOPLE
CAP REPAIRS					
EROSION CONTROL	74	AC	225	16,650	
FREEZE/THAW REPAIRS	74	AC	225	16,650	
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					CLEAN PIPELINE EVERY 5 YEARS
LEACHATE COLLECTION SYSTEM	5720	LF	0.5	2,860	
GROUNDWATER INTERCEPTION SYSTEM	3100	LF	0.5	1,550	

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /lb OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 5): $193,000 /YEAR
   COST (YEARS 5 TO 30): $40,000 /YEAR

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 5: ACCESS RESTRICTIONS WITH RCRA CAP, MODIFIED GROUNDWATER INTERCEPTION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$24,869,000			$24,869,000
1		$1,170,000	0.90909	$1,063,635
2		$941,000	0.82645	$777,689
3		$941,000	0.75131	$706,983
4		$941,000	0.68301	$642,712
5		$946,910	0.62092	$587,955
6		$799,000	0.56447	$451,012
7		$[illegible],000	0.51316	$410,015
8		$799,000	0.46651	$372,741
9		$799,000	0.4241	$338,856
10		$812,910	0.38554	$313,409
11		$799,000	0.35049	$280,042
12		$799,000	0.31863	$254,585
13		$799,000	0.28966	$231,438
14		$799,000	0.26333	$210,401
15	$1,020,000	$804,910	0.23939	$436,865
16		$799,000	0.21763	$173,886
17		$799,000	0.19784	$158,074
18		$799,000	0.17986	$143,708
19		$799,000	0.16351	$130,644
20		$812,910	0.14864	$120,831
21		$799,000	0.13513	$107,969
22		$799,000	0.12285	$98,157
23		$799,000	0.11168	$89,232
24		$799,000	0.10153	$81,122
25		$804,910	0.0923	$74,293
26		$799,000	0.08391	$67,044
27		$799,000	0.07628	$60,948
28		$799,000	0.06934	$55,403
29		$799,000	0.06304	$50,369
30	$8,985,000	$812,910	0.05731	$561,518
TOTAL O&M PRESENT WORTH				$8,292,000
TOTAL REPLACEMENT PRESENT WORTH				$759,000
TOTAL PRESENT WORTH				$33,921,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $957,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $77,000

ANNUAL O & M COSTS:

ANNUAL COSTS	FIRST YEAR	AFTER FIRST YEAR
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	30,800
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$118,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	3,600
MOWING	49,580
PUMP ELECTRICITY	
GROUNDWATER INTERCEPTION	2,000
LEACHATE COLLECTION	1,000
TOTAL ANNUAL COSTS ($/YEAR)	$197,000
NONANNUAL MAINTENANCE ($/ACTIVITY)	
REFURBISH SCREENS (EVERY 10 YEARS)	
MONITORING WELLS	$6,000
GROUNDWATER INTERCEPTION SYSTEM	$2,000
GROUNDWATER/LEACHATE COLLECTION	
PUMP REPLACEMENT	
FRENCH DRAIN (EVERY 5 YEARS)	$1,000
LEACHATE COLLECTION (EVERY 5 YEARS)	$500
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION SYSTEM	$2,860
GROUNDWATER INTERCEPTION SYSTEM	$1,550

TREATMENT SYSTEM FLOW RATE @ 101 GPM - FIRST 5 YEARS	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	38,745
SLUDGE DISPOSAL	68,880
CHEMICAL USAGE	
FERROUS SULFATE	169
ALKALI	18,490
POLYMER	2,945
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	8,685
SOLIDS DISPOSAL	15,440
CARBON USAGE	54,400
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$636,000

TREATMENT SYSTEM FLOW RATE @ 66 GPM - AFTER 5 YEARS	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	14,965
SLUDGE DISPOSAL	26,640
CHEMICAL USAGE	
FERROUS SULFATE	70
ALKALI	7,415
POLYMER	1,920
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	1,800
SOLIDS DISPOSAL	3,200
CARBON USAGE	9,200
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$494,000

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300 FT. HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
2. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
3. ECC SITE WORK						
REMOVE PROCESS BUILDING						
BUILDING REMOVAL	108750	CF	0.2	21,750		SINGLE BLDG, NO SALVAGE
FOUNDATION DEMOLITION	3625	SF	3.3	11,963		CONCRETE SLAB, REINFORCED 1 FOOT THICK
DISPOSAL	360	CY	3.7	1,332		DEMOLISHED BUILDING VOLUME AND FDN. VOLUME
REMOVE CONCRETE PAD						
DEMOLITION	30500	SF	3	91,500		DEMOLISH CONCRETE PAD
DISPOSAL	850	CY	3.7	3,145		ASSUME 0.75 FEET THICK
REMOVE CONTAMINATED SLUDGE/SOIL						
TESTING PRIOR TO EXCAVATION	1	LS	14000	14,000		
EXCAVATE	1825	CY	3.4	6,205		BACKHOE EXCAV, & DOUBLED FOR H&S
TRUCK LINERS	37	EA	200	7,400		
HAUL OFFSITE	730	CY	43	31,390		225 MI HAUL, 730 CY
DISPOSAL @ RCRA FACILITY	730	CY	80	58,400		
REMOVE EXTRACTED CONTAMINATED GROUNDWAT						
HAUL OFFSITE	9000	GAL	0.24	2,160		$450/TRUCK, $3.25/MILE, 225 MILES TO FACILITY
TREATMENT @ RCRA FACILITY	9000	GAL	0.24	2,160		TRUCK HANDLING AND TREATMENT
SUBTOTAL					$251,000	
4. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		
SUBTOTAL					$81,000	
5. RCRA CAP CONSTRUCTION						
PRELIMINARY GRADING						
FILL - EXCAVATE & HAUL	213100	CY	6	1,278,600		USE ONSITE SOIL (COMMON EARTH)
FILL - BACKFILL	213100	CY	3	639,300		
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
SYNTEHTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870		HYDRAULIC SPREADER
SUBTOTAL					$10,903,000	
6. GROUNDWATER ISOLATION AND COLLECTION						TO ISOLATE LANDFILL FROM GROUNDWATER
EXTRACTION WELLS						WELL EJECTOR SYSTEM
INSTALL WELLS	3930	LF	60	235,800		8 IN DIAMETER, AIR ROTARY DRILLED
EJECTORS	82	EA	500	41,000		
HEADER PIPE	3800	LF	4	15,200		4 IN DIAMETER, METAL
PUMPS	2	EA	3000	6,000		(ROUGH ESTIMATE ON COST)
CONNECTIONS	328	EA	45	14,760		METAL ELBOWS, 4 PER WELL
VALVES	328	EA	300	98,400		METAL BALL VALVES, 4 PER WELL
COLLECTION PIPE	2000	LF	4	8,000		METAL, 4 IN DIAMETER
TRENCH FOR PIPE	600	CY	5	3,000		4 FT DEEP, 3 FT WIDE
FRENCH DRAINS						
SHORING AND BRACING	139100	SF	2	278,200		WOOD SHEETING, WALES, BRACES
DEWATERING	6	EA	605	3,630		SUMP PUMPS
EXCAVATE TRENCH	20600	CY	4	82,400		
LINE TRENCH						
IMPERVIOUS MEMBRANE	53800	SF	0.2	10,760		
PERVIOUS GEOTEXTILE	246400	SF	0.17	41,888		
PERFORATED PIPE	5500	LF	6	33,000		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	20600	CY	15	309,000		GRAVEL FILL, COMPACTED
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	7	EA	1902	13,314		PRECAST CONC., 4' ID, 25' DEEP
SUBTOTAL					$1,199,000	
7. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP
SUBTOTAL					$435,000	
8. GROUNDWATER COLLECTION - ECC						
FRENCH DRAINS						
SOIL BORING PRIOR TO EXCAVATION	1	LS	36000	36,000		46 BORINGS ON 50 FT CENTERS
SHORING AND BRACING	92000	SF	2	184,000		TRENCH - 17' DEEP, 4' WIDE, 5400' LONG (TOTAL), WOOD SH
DEWATERING	4	EA	440	1,760		SUMP PUMPS
EXCAVATE TRENCH	13600	CY	4	54,400		
PERVIOUS GEOTEXTILE	205200	SF	0.17	34,884		
PERFORATED PIPE	4700	LF	4	18,800		METAL, 4" DIA.
GRAVEL BACKFILL	13600	CY	15	204,000		GRAVEL BACKFILL, COMPACTED
COLLECTOR & RISER PIPE	1000	LF	4	4,000		METAL, 4" DIA.
CONNECTIONS	18	EA	39	702		(TOTAL #)
WET WELL	1	EA	2300	2,300		PRECAST CONC., MANHOLE, 6' ID, 16' DEEP
SUMP PUMP	1	EA	2100	2,100		
SUBTOTAL					$507,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
9. GROUNDWATER/LEACHATE TREATMENT						DESIGN RATE OF 341 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	134,000	134,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	2,000	2,000		FRP TANK
NEUTRALIZATION TANK	1	LS	4,300	4,300		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	715,000	715,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	95,000	95,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					$2,023,000	
10. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$15,751,000	
11. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				788,000		
HEALTH AND SAFETY (15 %)				2,363,000		
BID CONTINGENCIES (15 %)				2,363,000		
SCOPE CONTINGENCIES (25 %)				3,938,000		
CONSTRUCTION TOTAL					$25,203,000	
12. OTHER						

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
PERMITTING (5 %)				1,260,000		
SERVICES DURING CONSTRUCTION				500,000		
TOTAL IMPLEMENTATION COST					$26,963,000	
13. ENGINEERING						
ENGINEERING DESIGN COST				600,000		
TOTAL CAPITAL COST					$27,563,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION AND LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. TREATMENT PLANT						REPLACEMENT AT YEAR 15, FLOWRATE OF 5 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	18,000	18,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	1,800	1,800		STEEL TANK
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	124,000	124,000		MODEL 55-A
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	23,000	23,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	5,000	5,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
RETROFIT EXPENSES	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$399,000	
2. RCRA CAP REPLACEMENT						REPLACEMENT AT 30 YEARS
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870		HYDRAULIC SPREADER
SUBTOTAL (TO NEAREST $1000)					$8,985,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST YEAR	TOTAL COST AFTER FIRST YEAR	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST YR., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	30,800	14 WELLS AFTER FIRST YEAR, $1100/WELL
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 341 GPM - - FIRST 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	1770	TON	45	79,650		
SLUDGE DISPOSAL	1770	TON	80	141,600		
CHEMICAL USAGE						
FERROUS SULFATE	281	LB	2.11	593		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	778500	LB	0.05	38,925		
POLYMER USAGE	2980	LB	3.35	9,983		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	770000	kw-h	0.05	38,500		
SOLIDS HAULING	253	TON	45	11,385		
SOLIDS DISPOSAL	253	TON	80	20,240		
CARBON USAGE	153300	LB	0.4	61,320		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 211 GPM - - YEARS 5 THROUGH 15						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	815	TON	45	36,675		
SLUDGE DISPOSAL	815	TON	80	65,200		
CHEMICAL USAGE						
FERROUS SULFATE	193	LB	2.11	407		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	373800	LB	0.05	18,690		
POLYMER USAGE	1840	LB	3.35	6,164		2 PPM PERCOL 776

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	770000	kw-h	0.05	38,500	
SOLIDS HAULING	72	TON	45	3,240	
SOLIDS DISPOSAL	72	TON	80	5,760	
CARBON USAGE	30300	LB	0.4	12,120	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 6 GPM - - AFTER 15 YEARS					
INFLUENT PUMPING					
ELECTRICITY	3270	kw-h	0.05	164	
PRECIPITATION SYSTEM					
ELECTRICITY	6540	kw-h	0.05	327	
SLUDGE HAULING	75	TON	45	3,375	
SLUDGE DISPOSAL	75	TON	80	6,000	
CHEMICAL USAGE					
FERROUS SULFATE	7	LB	2.11	15	AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	31800	LB	0.05	1,590	
POLYMER USAGE	47	LB	3.35	157	2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	26000	kw-h	0.05	1,300	
SOLIDS HAULING	22	TON	45	990	
SOLIDS DISPOSAL	22	TON	80	1,760	
CARBON USAGE	16400	LB	0.4	6,560	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	33000	kw-h	0.05	1,650	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
3. PUMP ELECTRICITY ($/YEAR)					
LEACHATE COLLECTION SYSTEM	1	LS	1000	1,000	
GROUNDWATER ISOLATION SYSTEM	1	LS	6000	6,000	
GROUNDWATER COLLECTION SYSTEM - ECC	1	LS	650	650	
4. INSPECTION ($/YEAR)					
SITE INSPECTION	1	LS	1800	3,600	1 E1, 1 TECH, 3 DAYS, TWICE PER YEAR
5. OTHER MAINTENANCE ($/YEAR)					
GROUNDWATER/LEACHATE COLLECTION					
EXTRACTION WELLS - EJECTOR REPLACEMENT	3	EA	2100	6,300	REPLACE ALL PUMPS EVERY 3 YEARS
FRENCH DRAIN PUMP REPLACEMENT	1	LS	1000	1,000	REPLACE EVERY 5 YEARS
LEACHATE COLLECTION PUMP REPLACEMENT	1	LS	500	500	REPLACE EVERY 5 YEARS
GROUNDWATER COLLECTION-ECC PUMP REPLACE	1	LS	2100	2,100	REPLACE EVERY 5 YEARS
REFURBISH WELL SCREENS					
MONITORING WELLS	1	LS	6000	6,000	CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
COLLECTION SYSTEM WELLS	1	LS	2000	2,000	CLEAN EVERY 10 YRS. - 4 WKS. LABOR, 2 PEOPLE
CAP REPAIRS					

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
EROSION CONTROL	74	AC	225	16,650	
FREEZE/THAW REPAIRS	74	AC	225	16,650	
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					CLEAN PIPELINE EVERY 5 YEARS
LEACHATE COLLECTION SYSTEM - NSL	5720	LF	0.5	2,860	
GROUNDWATER ISOLATION SYSTEM	5500	LF	0.5	2,750	
GROUNDWATER COLLECTION SYSTEM - ECC	5400	LF	0.5	2,700	

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /lb OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 5): $253,000 /YEAR
   COST (YEARS 5 TO 15): $72,000 /YEAR
   COST (YEARS 15 TO 30): $22,000 /YEAR

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 6: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$27,563,000			$27,563,000
1		$1,331,000	0.90909	$1,209,999
2		$1,102,000	0.82645	$910,748
3		$1,108,300	0.75131	$832,677
4		$1,102,000	0.68301	$752,677
5		$1,113,910	0.62092	$691,649
6		$893,300	0.56447	$504,241
7		$887,000	0.51316	$455,173
8		$887,000	0.46651	$413,794
9		$893,300	0.4241	$378,849
10		$906,910	0.38554	$349,650
11		$887,000	0.35049	$310,885
12		$893,300	0.31863	$284,632
13		$887,000	0.28966	$256,928
14		$887,000	0.26333	$233,574
15	$399,000	$905,210	0.23939	$312,215
16		$714,000	0.21763	$155,388
17		$714,000	0.19784	$141,258
18		$720,300	0.17986	$129,553
19		$714,000	0.16351	$116,746
20		$733,910	0.14864	$109,088
21		$720,300	0.13513	$97,334
22		$714,000	0.12285	$87,715
23		$714,000	0.11168	$79,740
24		$720,300	0.10153	$73,132
25		$725,910	0.0923	$67,001
26		$714,000	0.08391	$59,912
27		$720,300	0.07628	$54,944
28		$714,000	0.06934	$49,509
29		$714,000	0.06304	$45,011
30	$8,985,000	$740,210	0.05731	$557,352

TOTAL O&M PRESENT WORTH	$9,111,000
TOTAL REPLACEMENT PRESENT WORTH	$610,000
TOTAL PRESENT WORTH	$37,284,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,201,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $96,000

ANNUAL O & M COSTS:

ANNUAL COSTS	FIRST YEAR	AFTER FIRST YEAR
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	30,800
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$118,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	3,600
MOWING	49,580
PUMP ELECTRICITY	
LEACHATE COLLECTION SYSTEM	1,000
GROUNDWATER ISOLATION SYSTEM	6,000
GROUNDWATER COLLECTION SYSTEM -ECC	650
TOTAL ANNUAL COSTS ($/YEAR)	$192,000

NONANNUAL MAINTENANCE ($/ACTIVITY)	
REFURBISH SCREENS (EVERY 10 YEARS)	
MONITORING WELLS	$6,000
COLLECTION SYSTEM WELLS	$2,000
GROUNDWATER/LEACHATE COLLECTION	
PUMP REPLACEMENT	
EJECTOR REPLACEMENT (EVERY 3 YEARS)	$6,300
FRENCH DRAIN (EVERY 5 YEARS)	$1,000
LEACHATE COLLECTION (EVERY 5 YEARS)	$500
GROUNDWATER COLLECT-ECC(EVERY 5 YRS)	$2,100
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION SYSTEM	$2,860
GROUNDWATER ISOLATION SYSTEM	$2,750
GROUNDWATER COLLECTION SYSTEM -ECC	$2,700

TREATMENT SYSTEM FLOW RATE @ 341 GPM - FIRST 5 YEARS	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	79,650
SLUDGE DISPOSAL	141,600
CHEMICAL USAGE	
FERROUS SULFATE	593
ALKALI	38,[illegible]25
POLYMER	9,983
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	11,385
SOLIDS DISPOSAL	20,240
CARBON USAGE	61,320
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$792,000

TREATMENT SYSTEM FLOW RATE @ 211 GPM - YEARS 5 TO 15	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	36,675
SLUDGE DISPOSAL	65,200
CHEMICAL USAGE	
FERROUS SULFATE	407
ALKALI	18,690
POLYMER	6,164
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	3,240
SOLIDS DISPOSAL	5,760
CARBON USAGE	12,120
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$577,000

TREATMENT SYSTEM FLOW RATE @ 6 GPM - AFTER 15 YEARS	
INFLUENT PUMPING	
ELECTRICITY	164
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	3,375
SLUDGE DISPOSAL	6,000
CHEMICAL USAGE	
FERROUS SULFATE	15
ALKALI	1,590
POLYMER	157
PACT SYSTEM	
ELECTRICITY	1,300
SOLIDS HAULING	990
SOLIDS DISPOSAL	1,760
CARBON USAGE	6,560
AIR COMPRESSOR	
ELECTRICITY	1,650
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$404,000

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300 FT. HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
2. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
3. ECC SITE WORK						
REMOVE PROCESS BUILDING						
BUILDING REMOVAL	108750	CF	0.2	21,750		SINGLE BLDG, NO SALVAGE
FOUNDATION DEMOLITION	3625	SF	3.3	11,963		CONCRETE SLAB, REINFORCED 1 FOOT THICK
DISPOSAL	360	CY	3.7	1,332		DEMOLISHED BUILDING VOLUME AND FDN. VOLUME
REMOVE CONCRETE PAD						
DEMOLITION	30500	SF	3	91,500		DEMOLISH CONCRETE PAD
DISPOSAL	850	CY	3.7	3,145		ASSUME 0.75 FEET THICK
REMOVE CONTAMINATED SLUDGE/SOIL						
TESTING PRIOR TO EXCAVATION	1	LS	14000	14,000		
EXCAVATE	1825	CY	3.4	6,205		BACKHOE EXCAV, & DOUBLED FOR H&S
TRUCK LINERS	37	EA	200	7,400		
HAUL OFFSITE	730	CY	43	31,390		225 MI HAUL, 730 CY
DISPOSAL @ RCRA FACILITY	730	CY	80	58,400		
REMOVE EXTRACTED CONTAMINATED GROUNDWAT						
HAUL OFFSITE	9000	GAL	0.24	2,160		$450/TRUCK, $3.25/MILE, 225 MILES TO FACILITY
TREATMENT @ RCRA FACILITY	9000	GAL	0.24	2,160		TRUCK HANDLING AND TREATMENT
SUBTOTAL					$251,000	
4. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		
SUBTOTAL					$81,000	
5. RCRA CAP CONSTRUCTION						
PRELIMINARY GRADING						
FILL - EXCAVATE & HAUL	213100	CY	6	1,278,600		USE ONSITE SOIL (COMMON EARTH)
FILL - BACKFILL	213100	CY	3	639,300		
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870		HYDRAULIC SPREADER
SUBTOTAL					$10,903,000	
6. GROUNDWATER ISOLATION AND COLLECTION						TO ISOLATE LANDFILL FROM GROUNDWATER
EXTRACTION WELLS						WELL EJECTOR SYSTEM
INSTALL WELLS	3930	LF	60	235,800		8 IN DIAMETER, AIR ROTARY DRILLED
EJECTORS	82	EA	500	41,000		
HEADER PIPE	3800	LF	4	15,200		4 IN DIAMETER, METAL
PUMPS	2	EA	3000	6,000		(ROUGH ESTIMATE ON COST)
CONNECTIONS	328	EA	45	14,760		METAL ELBOWS, 4 PER WELL
VALVES	328	EA	300	98,400		METAL BALL VALVES, 4 PER WELL
COLLECTION PIPE	2000	LF	4	8,000		METAL, 4 IN DIAMETER
TRENCH FOR PIPE	600	CY	5	3,000		4 FT DEEP, 3 FT WIDE
FRENCH DRAINS						
SHORING AND BRACING	139100	SF	2	278,200		WOOD SHEETING, WALES, BRACES
DEWATERING	6	EA	605	3,630		SUMP PUMPS
EXCAVATE TRENCH	20600	CY	4	82,400		
LINE TRENCH						
IMPERVIOUS MEMBRANE	53800	SF	0.2	10,760		
PERVIOUS GEOTEXTILE	246400	SF	0.17	41,888		
PERFORATED PIPE	5500	LF	6	33,000		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	20600	CY	15	309,000		GRAVEL FILL, COMPACTED
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	7	EA	1902	13,314		PRECAST CONC., 4' ID, 25' DEEP
SUBTOTAL					$1,199,000	
7. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP
SUBTOTAL					$435,000	
8. GROUNDWATER COLLECTION - ECC						
FRENCH DRAINS						
SOIL BORING PRIOR TO EXCAVATION	1	LS	36000	36,000		46 BORINGS ON 50 FT CENTERS
SHORING AND BRACING	92000	SF	2	184,000		TRENCH - 17' DEEP, 4' WIDE, 5400' LONG (TOTAL), WOOD SH
DEWATERING	4	EA	440	1,760		SUMP PUMPS
EXCAVATE TRENCH	13600	CY	4	54,400		
PERVIOUS GEOTEXTILE	205200	SF	0.17	34,884		
PERFORATED PIPE	4700	LF	4	18,800		METAL, 4" DIA.
GRAVEL BACKFILL	13600	CY	15	204,000		GRAVEL BACKFILL, COMPACTED
COLLECTOR & RISER PIPE	1000	LF	4	4,000		METAL, 4" DIA.
CONNECTIONS	18	EA	39	702		(TOTAL #)
WET WELL	1	EA	2300	2,300		PRECAST CONC., MANHOLE, 6' ID, 16' DEEP
SUMP PUMP	1	EA	2100	2,100		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
SUBTOTAL					$507,000	
9. GROUNDWATER/LEACHATE TREATMENT						DESIGN RATE OF 341 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	134,000	134,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	2,000	2,000		FRP TANK
NEUTRALIZATION TANK	1	LS	4,300	4,300		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	715,000	715,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	95,000	95,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					$2,023,000	
10. SOIL VAPOR EXTRACTION - ECC						
PILOT TESTING	1	LS	75000	75,000		
SAMPLING PRIOR TO EXTRACTION						
26 SOIL BORINGS	208	LF	40	8,320		
SAMPLE COLLECTION	1	LS	8400	8,400		
VOC ANALYSIS WITH B/N	52	EA	800	41,600		
EXTRACTION WELLS	640	LF	32	20,480		
INLET WELLS	640	LF	32	20,480		
CONNECTING PIPE	2000	LF	6	12,000		
BLOWER ASSEMBLY	10	EA	4100	41,000		
GAC SYSTEM FOR VAPOR						
CARBON ADSORBER SYSTEM	1	LS	200000	200,000		4 MODULES @ $50,000 EACH
CARBON TRANSFER TANK	1	LS	20000	20,000		
WATER HEATER	1	LS	9000	9,000		3.5 FEET DIA. X 8 FOOT HIGH
PUMP AND PIPING	1	LS	1000	1,000		
HEAT EXCHANGER	1	LS	13000	13,000		
CHLORINATION SYSTEM	1	LS	5000	5,000		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
TRENCH EXCAVATION	340	CY	4.5	1,530		5 FT. DEEP X 2 FOOT WIDE X 900 FEET, DOUBLE FOR H&S
PIPING TO TREATMEN.	1	LS	11600	11,600		
AIR MONITORING	1	LS	4000	4,000		
START-UP	1	LS	8000	8,000		
SUBTOTAL					$500,000	
11. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$16,251,000	
12. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				813,000		
HEALTH AND SAFETY (15 %)				2,438,000		
BID CONTINGENCIES (15 %)				2,438,000		
SCOPE CONTINGENCIES (25 %)				4,063,000		
CONSTRUCTION TOTAL					$26,003,000	
13. OTHER						
PERMITTING (5 %)				1,300,000		
SERVICES DURING CONSTRUCTION				550,000		
TOTAL IMPLEMENTATION COST					$27,853,000	
14. ENGINEERING						
ENGINEERING DESIGN COST				650,000		
TOTAL CAPITAL COST					$28,503,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION AND LEACHATE COLLECTION AND TREATMENT
SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
REPLACEMENT COSTS					
1. TREATMENT PLANT					REPLACEMENT AT YEAR 15, FLOWRATE OF 5 GPM
INFLUENT PUMPING					
EQUALIZATION/STORAGE	1	LS	100,000	100,000	100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200	SUBMERSIBLE PUMP
PRECIPITATION SYSTEM					
IN-LINE MIXER	1	EA	850	850	2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	18,000	18,000	AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000	J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200	FRP TANK
NEUTRALIZATION TANK	1	LS	1,800	1,800	STEEL TANK
STARTUP	4	DAY	500	2,000	
PACT SYSTEM					
PACT PACKAGE	1	LS	124,000	124,000	MODEL 55-A
STARTUP	4	DAY	500	2,000	
GRANULAR MEDIA FILTER	1	LS	23,000	23,000	AVERAGE PRICE OF TWO SYSTEMS
OTHER					
AIR COMPRESSOR	1	LS	5,000	5,000	
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000	
RETROFIT EXPENSES	1	LS	20,000	20,000	
SUBTOTAL (TO NEAREST $1000)				$399,000	
2. RCRA CAP REPLACEMENT					REPLACEMENT AT 30 YEARS
DRAINAGE LAYER					1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000	
BACKFILL	113000	CY	3	339,000	
CLAY LAYER					2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000	
BACKFILL	247000	CY	3	741,000	
GEOTEXTILE	740000	SY	1.5	1,110,000	2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	370000	SY	1.8	666,000	30 MIL. PVC
SAND LAYER					USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000	
BACKFILL	185000	CY	3	555,000	
ESTABLISH VEGETATIVE COVER					
SOIL	124000	CY	5	620,000	ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870	HYDRAULIC SPREADER
SUBTOTAL (TO NEAREST $1000)				$8,985,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST YEAR	TOTAL COST AFTER FIRST YEAR	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST YR., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	30,800	14 WELLS AFTER FIRST YEAR, $1100/WELL
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 341 GPM - - FIRST 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	1770	TON	45	79,650		
SLUDGE DISPOSAL	1770	TON	80	141,600		
CHEMICAL USAGE						
FERROUS SULFATE	281	LB	2.11	593		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	778500	LB	0.05	38,925		
POLYMER USAGE	2980	LB	3.35	9,983		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	770000	kw-h	0.05	38,500		
SOLIDS HAULING	253	TON	45	11,385		
SOLIDS DISPOSAL	253	TON	80	20,240		
CARBON USAGE	153300	LB	0.4	61,320		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 211 GPM - - YEARS 5 THROUGH 15						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	815	TON	45	36,675		
SLUDGE DISPOSAL	815	TON	80	65,200		
CHEMICAL USAGE						
FERROUS SULFATE	193	LB	2.11	407		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	373800	LB	0.05	18,690		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT
SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
POLYMER USAGE	1840	LB	3.35	6,164	2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	770000	kw-h	0.05	38,500	
SOLIDS HAULING	72	TON	45	3,240	
SOLIDS DISPOSAL	72	TON	80	5,760	
CARBON USAGE	30300	LB	0.4	12,120	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 6 GPM - - AFTER 15 YEARS					
INFLUENT PUMPING					
ELECTRICITY	3270	kw-h	0.05	164	
PRECIPITATION SYSTEM					
ELECTRICITY	6540	kw-h	0.05	327	
SLUDGE HAULING	75	TON	45	3,375	
SLUDGE DISPOSAL	75	TON	80	6,000	
CHEMICAL USAGE					
FERROUS SULFATE	7	LB	2.11	15	AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME	31800	LB	0.05	1,590	
POLYMER USAGE	47	LB	3.35	157	2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	26000	kw-h	0.05	1,300	
SOLIDS HAULING	22	TON	45	990	
SOLIDS DISPOSAL	22	TON	80	1,760	
CARBON USAGE	16400	LB	0.4	6,560	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	33000	kw-h	0.05	1,650	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
3. SOIL VAPOR EXTRACTION SYSTEM					
BLOWER ELECTRICITY	457000	kw*h	0.05	22,850	
AIR MONITORING					
KEY COMPONENET ANALYSIS	120	EA	70	8,400	
VOLATILE SCAN WITH BASE/NEUTRALS	40	EA	800	32,000	
SAMPLING TRIP	36	DAYS	100	3,600	
GRANULAR ACTIVATED CARBON SYSTEM					
CARBON REPLACEMENT	126000	LB	1.5	189,000	
CARBON HAULING	63	TON	45	2,835	
CARBON DISPOSAL	63	TON	80	5,040	
ELECTRICITY	124000	kw*h	0.05	6,200	
MATERIALS	1	LS	48000	48,000	
LAB ANALYSIS	1	LS	1000	1,000	
LABOR	1040	HR	30	31,200	
SUPERVISION	102	HR	45	4,590	
4. PUMP ELECTRICITY ($/YEAR)					

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL VAPOR EXTRACTION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
LEACHATE COLLECTION SYSTEM	1	LS	1000	1,000	
GROUNDWATER ISOLATION SYSTEM	1	LS	6000	6,000	
GROUNDWATER COLLECTION SYSTEM - ECC	1	LS	650	650	
5. INSPECTION ($/YEAR)					
SITE INSPECTION	1	LS	1800	3,600	1 E1, 1 TECH, 3 DAYS, TWICE PER YEAR
6. OTHER MAINTENANCE ($/YEAR)					
GROUNDWATER/LEACHATE COLLECTION					
EXTRACTION WELLS - EJECTOR REPLACEMENT	3	EA	2100	6,300	REPLACE ALL PUMPS EVERY 3 YEARS
FRENCH DRAIN PUMP REPLACEMENT	1	LS	1000	1,000	REPLACE EVERY 5 YEARS
LEACHATE COLLECTION PUMP REPLACEMENT	1	LS	500	500	REPLACE EVERY 5 YEARS
GROUNDWATER COLLECTION-ECC PUMP REPLACE	1	LS	2100	2,100	REPLACE EVERY 5 YEARS
REFURBISH WELL SCREENS					
MONITORING WELLS	1	LS	6000	6,000	CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
COLLECTION SYSTEM WELLS	1	LS	2000	2,000	CLEAN EVERY 10 YRS. - 4 WKS. LABOR, 2 PEOPLE
CAP REPAIRS					
EROSION CONTROL	74	AC	225	16,650	
FREEZE/THAW REPAIRS	74	AC	225	16,650	
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					CLEAN PIPELINE EVERY 5 YEARS
LEACHATE COLLECTION SYSTEM - NSL	5720	LF	0.5	2,860	
GROUNDWATER ISOLATION SYSTEM	5500	LF	0.5	2,750	
GROUNDWATER COLLECTION SYSTEM - ECC	5400	LF	0.5	2,700	

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /LB OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 5): $253,000 /YEAR
   COST (YEARS 5 TO 15): $72,000 /YEAR
   COST (YEARS 15 TO 30): $22,000 /YEAR

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 7: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT
SOIL VAPOR EXTRACTION AT ECC

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$28,503,000			$28,503,000
1		$1,685,715	0.90909	$1,532,467
2		$1,456,715	0.82645	$1,203,902
3		$1,463,015	0.75131	$1,099,178
4		$1,456,715	0.68301	$994,951
5		$1,113,910	0.62092	$691,649
6		$893,300	0.56447	$504,241
7		$887,000	0.51316	$455,173
8		$887,000	0.46651	$413,794
9		$893,300	0.4241	$378,849
10		$906,910	0.38554	$349,650
11		$887,000	0.35049	$310,885
12		$893,300	0.31863	$284,632
13		$887,000	0.28966	$256,928
14		$887,000	0.26333	$233,574
15	$399,000	$905,210	0.23939	$312,215
16		$714,000	0.21763	$155,388
17		$714,000	0.19784	$141,258
18		$720,300	0.17986	$129,553
19		$714,000	0.16351	$116,746
20		$733,910	0.14864	$109,088
21		$720,300	0.13513	$97,334
22		$714,000	0.12285	$87,715
23		$714,000	0.11168	$79,740
24		$720,300	0.10153	$73,132
25		$725,910	0.0923	$67,001
26		$714,000	0.08391	$59,912
27		$720,300	0.07628	$54,944
28		$714,000	0.06934	$49,509
29		$714,000	0.06304	$45,011
30	$8,985,000	$740,210	0.05731	$557,352
TOTAL O&M PRESENT WORTH				$10,235,000
TOTAL REPLACEMENT PRESENT WORTH				$610,000
TOTAL PRESENT WORTH				$39,349,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO "" IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,201,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $96,000

ANNUAL O & M COSTS:

ANNUAL COSTS	FIRST YEAR	AFTER FIRST YEAR
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	30,800
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$118,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	3,600
MOWING	49,580
PUMP ELECTRICITY	
LEACHATE COLLECTION SYSTEM	1,000
GROUNDWATER ISOLATION SYSTEM	6,000
GROUNDWATER COLLECTION SYSTEM -ECC	650
TOTAL ANNUAL COSTS ($/YEAR)	$192,000
NONANNUAL MAINTENANCE ($/ACTIVITY)	
REFURBISH SCREENS (EVERY 10 YEARS)	
MONITORING WELLS	$6,000
COLLECTION SYSTEM WELLS	$2,000
GROUNDWATER/LEACHATE COLLECTION	
PUMP REPLACEMENT	
EJECTOR REPLACEMENT (EVERY 3 YEARS)	$6,300
FRENCH DRAIN (EVERY 5 YEARS)	$1,000
LEACHATE COLLECTION (EVERY 5 YEARS)	$500
GROUNDWATER COLLECT-ECC(EVERY 5 YRS)	$2,100
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION SYSTEM	$2,860
GROUNDWATER ISOLATION SYSTEM	$2,750
GROUNDWATER COLLECTION SYSTEM -ECC	$2,700

TREATMENT SYSTEM FLOW RATE @ 341 GPM - FIRST 5 YEARS		TREATMENT SYSTEM FLOW RATE @ 6 GPM - AFTER 15 YEARS	
INFLUENT PUMPING		INFLUENT PUMPING	
ELECTRICITY	980	ELECTRICITY	164
PRECIPITATION SYSTEM		PRECIPITATION SYSTEM	
ELECTRICITY	327	ELECTRICITY	327
SLUDGE HAULING	79,650	SLUDGE HAULING	3,375
SLUDGE DISPOSAL	141,600	SLUDGE DISPOSAL	6,000
CHEMICAL USAGE		CHEMICAL USAGE	
FERROUS SULFATE	593	FERROUS SULFATE	15
ALKALI	38,925	ALKALI	1,590
POLYMER	9,983	POLYMER	157
PACT SYSTEM		PACT SYSTEM	
ELECTRICITY	38,500	ELECTRICITY	1,300
SOLIDS HAULING	11,385	SOLIDS HAULING	990
SOLIDS DISPOSAL	20,240	SOLIDS DISPOSAL	1,760
CARBON USAGE	61,320	CARBON USAGE	6,560
AIR COMPRESSOR		AIR COMPRESSOR	
ELECTRICITY	8,200	ELECTRICITY	1,650
MAINTENANCE	250,560	MAINTENANCE	250,560
SUPERVISION	93,960	SUPERVISION	93,960
EFFLUENT MONITORING	33,600	EFFLUENT MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400	SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$792,000	OPERATING COST	$404,000

TREATMENT SYSTEM FLOW RATE @ 211 GPM - YEARS 5 TO 15		SOIL VAPOR EXTRACTION SYSTEM - ECC FIRST 4 YEARS	
INFLUENT PUMPING		BLOWER ELECTRICITY	22,850
ELECTRICITY	980	AIR MONITORING	
PRECIPITATION SYSTEM		KEY COMPONENT ANALYSIS	8,400
ELECTRICITY	327	VOLATILE SCAN W/ B/N	32,000
SLUDGE HAULING	36,675	SAMPLING TRIP	3,600
SLUDGE DISPOSAL	65,200	GRANULAR ACTIVATED CARBON	
CHEMICAL USAGE		CARBON REPLACEMENT	189,000
FERROUS SULFATE	407	CARBON HAULING	2,835
ALKALI	18,690	CARBON DISPOSAL	5,040
POLYMER	6,164	ELECTRICITY	6,200
PACT SYSTEM		MATERIALS	48,000
ELECTRICITY	38,500	LAB ANALYSIS	1,000
SOLIDS HAULING	3,240	LABOR	31,200
SOLIDS DISPOSAL	5,760	SUPERVISION	4,590
CARBON USAGE	12,120	SUBTOTAL	$354,715
AIR COMPRESSOR			
ELECTRICITY	8,200		
MAINTENANCE	250,560		
SUPERVISION	93,960		
EFFLUENT MONITORING	33,600		
SAMPLE SHIPPING CHARGES	2,400		
OPERATING COST	$577,000		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300 FT. HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
2. REROUTE FINLEY CREEK AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL (WET)
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
3. ECC SITE WORK						
REMOVE PROCESS BUILDING						
BUILDING REMOVAL	108750	CF	0.2	21,750		SINGLE BLDG, NO SALVAGE
FOUNDATION DEMOLITION	3625	SF	3.3	11,963		CONCRETE SLAB, REINFORCED 1 FOOT THICK
DISPOSAL	360	CY	3.7	1,332		DEMOLISHED BUILDING VOLUME AND FDN. VOLUME
REMOVE CONCRETE PAD						
DEMOLITION	30500	SF	3	91,500		DEMOLISH CONCRETE PAD
DISPOSAL	850	CY	3.7	3,145		ASSUME 0.75 FEET THICK
REMOVE CONTAMINATED SLUDGE/SOIL						
TESTING PRIOR TO EXCAVATION	1	LS	14000	14,000		
EXCAVATE	1825	CY	3.4	6,205		BACKHOE EXCAV, & DOUBLED FOR H&S
TRUCK LINERS	37	EA	200	7,400		
HAUL OFFSITE	730	CY	43	31,390		225 MI HAUL, 730 CY
DISPOSAL @ RCRA FACILITY	730	CY	80	58,400		
REMOVE EXTRACTED CONTAMINATED GROUNDWAT						
HAUL OFFSITE	9000	GAL	0.24	2,160		$450/TRUCK, $3.25/MILE, 225 MILES TO FACILITY
TREATMENT @ RCRA FACILITY	9000	GAL	0.24	2,160		TRUCK HANDLING AND TREATMENT
SUBTOTAL					$251,000	
4. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		
SUBTOTAL					$81,000	
5. RCRA CAP CONSTRUCTION						
PRELIMINARY GRADING						
FILL - EXCAVATE & HAUL	213100	CY	6	1,278,600		USE ONSITE SOIL (COMMON EARTH)
FILL - BACKFILL	213100	CY	3	639,300		
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE
SYNTENTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870		HYDRAULIC SPREADER
SUBTOTAL					$10,903,000	
6. GROUNDWATER ISOLATION AND COLLECTION						TO ISOLATE LANDFILL FROM GROUNDWATER
EXTRACTION WELLS						WELL EJECTOR SYSTEM
INSTALL WELLS	3930	LF	60	235,800		8 IN DIAMETER, AIR ROTARY DRILLED
EJECTORS	82	EA	500	41,000		
HEADER PIPE	3800	LF	4	15,200		4 IN DIAMETER, METAL
PUMPS	2	EA	3000	6,000		(ROUGH ESTIMATE ON COST)
CONNECTIONS	328	EA	45	14,760		METAL ELBOWS, 4 PER WELL
VALVES	328	EA	300	98,400		METAL BALL VALVES, 4 PER WELL
COLLECTION PIPE	2000	LF	4	8,000		METAL, 4 IN DIAMETER
TRENCH FOR PIPE	600	CY	5	3,000		4 FT DEEP, 3 FT WIDE
FRENCH DRAINS						
SHORING AND BRACING	139100	SF	2	278,200		WOOD SHEETING, WALES, BRACES
DEWATERING	6	EA	605	3,630		SUMP PUMPS
EXCAVATE TRENCH	20600	CY	4	82,400		
LINE TRENCH						
IMPERVIOUS MEMBRANE	53800	SF	0.2	10,760		
PERVIOUS GEOTEXTILE	246400	SF	0.17	41,888		
PERFORATED PIPE	5500	LF	6	33,000		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	20600	CY	15	309,000		GRAVEL FILL, COMPACTED
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	7	EA	1902	13,314		PRECAST CONC., 4' ID, 25' DEEP
SUBTOTAL					$1,199,000	
7. LEACHATE COLLECTION SYSTEM						
EXCAVATE TRENCH	2540	CY	8	20,320		4' DEEP, $ DOUBLED FOR H & S
LINE TRENCH						
PERVIOUS GEOTEXTILE	62900	SF	0.17	10,693		
PERFORATED PIPE	5720	LF	6	34,320		METAL, 8" DIA., 16 GAGE
GRAVEL BACKFILL	24150	CY	15	362,250		IN TRENCH & UP SLOPE
SUMP/PUMP STATION	1	EA	4500	4,500		FIBERGLASS SUMP, INCLUDES PUMP(SIMPLEX) AND CONTROLS
MANHOLES	5	EA	650	3,250		PRECAST CONC., 4' ID, 6' DEEP
SUBTOTAL					$435,000	
8. GROUNDWATER COLLECTION - ECC						
FRENCH DRAINS						
SOIL BORING PRIOR TO EXCAVATION	1	LS	36000	36,000		46 BORINGS ON 50 FT CENTERS
SHORING AND BRACING	92000	SF	2	184,000		TRENCH - 17' DEEP, 4' WIDE, 5400' LONG (TOTAL), WOOD SH
DEWATERING	4	EA	440	1,760		SUMP PUMPS
EXCAVATE TRENCH	13600	CY	4	54,400		
PERVIOUS GEOTEXTILE	205200	SF	0.17	34,884		
PERFORATED PIPE	4700	LF	4	18,800		METAL, 4" DIA.
GRAVEL BACKFILL	13600	CY	15	204,000		GRAVEL BACKFILL, COMPACTED
COLLECTOR & RISER PIPE	1000	LF	4	4,000		METAL, 4" DIA.
CONNECTIONS	18	EA	39	702		(TOTAL #)
WET WELL	1	EA	2300	2,300		PRECAST CONC., MANHOLE, 6' ID, 16' DEEP
SUMP PUMP	1	EA	2100	2,100		

APPENDIX TABLE A-25

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
SUBTOTAL					$507,000	
9. GROUNDWATER/LEACHATE TREATMENT						DESIGN RATE OF 341 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	1,550	1,550		4 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	134,000	134,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
SOLIDS STORAGE TANK	1	LS	2,000	2,000		FRP TANK
NEUTRALIZATION TANK	1	LS	4,300	4,300		STEEL TANK
PILOT TESTING	1	LS	5,000	5,000		
STARTUP	5	DAY	500	2,500		
PACT SYSTEM						
PACT PACKAGE	1	LS	715,000	715,000		MODEL 55-A
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 cu ft
PILOT TESTING	1	LS	20,000	20,000		
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	95,000	95,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	16,000	16,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
BUILDING	30000	SF	25	750,000		
SITE WORK						
SITE PREPARATION						SITE AREA: 300 FT X 200 FT, 1 FT DEPTH, 6 IN LEVEL
CLEARING	2200	CY	4	8,800		
GRADING	6700	SY	1	6,700		
LEVELING	1100	CY	3	3,300		
SITE DRAINAGE						3 FT DEEP X 4 FT WIDE, 100 FT TRENCH
EXCAVATION	50	CY	4	200		
PIPE	100	LF	6	600		
BACKFILL	50	CY	6	300		
ACCESS ROAD						20 FT WIDE BY 200 FT LONG
ROAD BASE	450	SY	2	900		
ROAD	450	SY	15	6,750		
SUBTOTAL					$2,023,000	
10. SOIL INCINERATION - ECC						ROTARY KILN SYSTEM
EQUIPMENT	1	LS	3550000	3,550,000		
INSTALLATION AND STARTUP	1	LS	3050000	3,050,000		
OPERATION	22000	CY	700	15,400,000		
SUBTOTAL					$22,000,000	
11. ACCESS RESTRICTIONS						
FENCING	9300	LF	12	111,600		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	62	EA	33	2,046		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$118,000	
CONSTRUCTION SUBTOTAL					$37,751,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
12. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (5 %)				1,888,000		
HEALTH AND SAFETY (15 %)				5,663,000		
BID CONTINGENCIES (15 %)				5,663,000		
SCOPE CONTINGENCIES (25 %)				9,438,000		
CONSTRUCTION TOTAL					$60,403,000	
13. OTHER						
PERMITTING (5 %)				3,020,000		
SERVICES DURING CONSTRUCTION				1,000,000		
TOTAL IMPLEMENTATION COST					$64,423,000	
14. ENGINEERING						
ENGINEERING DESIGN COST				2,000,000		
TOTAL CAPITAL COST					$66,423,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION AND LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. TREATMENT PLANT						REPLACEMENT AT YEAR 15, FLOWRATE OF 5 GPM
INFLUENT PUMPING						
EQUALIZATION/STORAGE	1	LS	100,000	100,000		100,000 GALLON EQUALIZATION/STORAGE TANK
PUMPS	2	EA	6,600	13,200		SUBMERSIBLE PUMP
PRECIPITATION SYSTEM						
IN-LINE MIXER	1	EA	850	850		2 IN. IN-LINE MIXER
PRECIPITATION SYSTEM PACKAGE	1	LS	18,000	18,000		AVERAGE PRICE OF TWO SYSTEMS
FILTER PRESS	1	LS	47,000	47,000		J-PRESS, 15 CU FT
SOLIDS STORAGE TANK	1	LS	1,200	1,200		FRP TANK
NEUTRALIZATION TANK	1	LS	1,800	1,800		STEEL TANK
STARTUP	4	DAY	500	2,000		
PACT SYSTEM						
PACT PACKAGE	1	LS	124,000	124,000		MODEL 55-A
STARTUP	4	DAY	500	2,000		
GRANULAR MEDIA FILTER	1	LS	23,000	23,000		AVERAGE PRICE OF TWO SYSTEMS
OTHER						
AIR COMPRESSOR	1	LS	5,000	5,000		
INSTRUMENTATION AND CONTROLS	1	LS	41,000	41,000		
RETROFIT EXPENSES	1	LS	20,000	20,000		
SUBTOTAL (TO NEAREST $1000)					$399,000	
2. RCRA CAP REPLACEMENT						REPLACEMENT AT 30 YEARS
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	113000	CY	8	904,000		
BACKFILL	113000	CY	3	339,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	247000	CY	10	2,470,000		
BACKFILL	247000	CY	3	741,000		
GEOTEXTILE	740000	SY	1.5	1,110,000		2 LAYERS OF POLYPROPYLENE
SYNTENTIC MEMBRANE	370000	SY	1.8	666,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	185000	CY	8	1,480,000		
BACKFILL	185000	CY	3	555,000		
ESTABLISH VEGETATIVE COVER						
SOIL	124000	CY	5	620,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	3329000	SF	0.03	99,870		HYDRAULIC SPREADER
SUBTOTAL (TO NEAREST $1000)					$8,985,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST YEAR	TOTAL COST AFTER FIRST YEAR	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST YR., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	30,800	14 WELLS AFTER FIRST YEAR, $1100/WELL
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES						
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. TREATMENT PLANT OPERATION ($/YEAR)						
TREATMENT SYSTEM FLOW RATE @ 341 GPM - - FIRST 5 YEARS						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	1770	TON	45	79,650		
SLUDGE DISPOSAL	1770	TON	80	141,600		
CHEMICAL USAGE						
FERROUS SULFATE	281	LB	2.11	593		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	778500	LB	0.05	38,925		
POLYMER USAGE	2980	LB	3.35	9,983		2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB				
PACT SYSTEM						
ELECTRICITY	770000	kw-h	0.05	38,500		
SOLIDS HAULING	253	TON	45	11,385		
SOLIDS DISPOSAL	253	TON	80	20,240		
CARBON USAGE	153300	LB	0.4	61,320		0.5 lb PAC/lb COD
OTHER EQUIPMENT						
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200		
MAINTENANCE	8352	HR	30	250,560		4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960		FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600		INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400		2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 211 GPM - - YEARS 5 THROUGH 15						
INFLUENT PUMPING						
ELECTRICITY	19600	kw-h	0.05	980		
PRECIPITATION SYSTEM						
ELECTRICITY	6540	kw-h	0.05	327		
SLUDGE HAULING	815	TON	45	36,675		
SLUDGE DISPOSAL	815	TON	80	65,200		
CHEMICAL USAGE						
FERROUS SULFATE	193	LB	2.11	407		AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	373800	LB	0.05	18,690		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
POLYMER USAGE	1840	LB	3.35	6,164	2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	770000	kw-h	0.05	38,500	
SOLIDS HAULING	72	TON	45	3,240	
SOLIDS DISPOSAL	72	TON	80	5,760	
CARBON USAGE	30300	LB	0.4	12,120	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	164000	kw-h	0.05	8,200	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
TREATMENT SYSTEM FLOW RATE @ 6 GPM - - AFTER 15 YEARS					
INFLUENT PUMPING					
ELECTRICITY	3270	kw-h	0.05	164	
PRECIPITATION SYSTEM					
ELECTRICITY	6540	kw-h	0.05	327	
SLUDGE HAULING	75	TON	45	3,375	
SLUDGE DISPOSAL	75	TON	80	6,000	
CHEMICAL USAGE					
FERROUS SULFATE	7	LB	2.11	15	AS FERROUS SULFATE HEPTAHYDRIDE
ALKALI (LIME)	31800	LB	0.05	1,590	
POLYMER USAGE	47	LB	3.35	157	2 PPM PERCOL 776
ACID USAGE	-MINIMAL-	LB			
PACT SYSTEM					
ELECTRICITY	26000	kw-h	0.05	1,300	
SOLIDS HAULING	22	TON	45	990	
SOLIDS DISPOSAL	22	TON	80	1,760	
CARBON USAGE	16400	LB	0.4	6,560	0.5 lb PAC/lb COD
OTHER EQUIPMENT					
AIR COMPRESSOR - ELECTRICITY	33000	kw-h	0.05	1,650	
MAINTENANCE	8352	HR	30	250,560	4 FULL TIME OPERATORS
SUPERVISION	2088	HR	45	93,960	FULL TIME SUPERVISOR
MONITORING	24	EA	1400	33,600	INFLUENT AND EFFLUENT SAMPLE ONCE PER MONTH
SAMPLE SHIPPING CHARGES	24	EA	100	2,400	2 SHIPMENTS PER MONTH
3. PUMP ELECTRICITY ($/YEAR)					
LEACHATE COLLECTION SYSTEM	1	LS	1000	1,000	
GROUNDWATER ISOLATION SYSTEM	1	LS	6000	6,000	
GROUNDWATER COLLECTION SYSTEM - ECC	1	LS	650	650	
4. INSPECTION ($/YEAR)					
SITE INSPECTION	1	LS	1800	3,600	1 E1, 1 TECH, 3 DAYS, TWICE PER YEAR
5. OTHER MAINTENANCE ($/YEAR)					
GROUNDWATER/LEACHATE COLLECTION					
EXTRACTION WELLS - EJECTOR REPLACEMENT	3	EA	2100	6,300	REPLACE ALL PUMPS EVERY 3 YEARS
FRENCH DRAIN PUMP REPLACEMENT	1	LS	1000	1,000	REPLACE EVERY 5 YEARS
LEACHATE COLLECTION PUMP REPLACEMENT	1	LS	500	500	REPLACE EVERY 5 YEARS
GROUNDWATER COLLECTION-ECC PUMP REPLACE	1	LS	2100	2,100	REPLACE EVERY 5 YEARS
REFURBISH WELL SCREENS					

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT SOIL INCINERATION AND CONSOLIDATION AT ECC

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS					
MONITORING WELLS	1	LS	6000	6,000	CLEAN EVERY 10 YRS. - 2 WKS. LABOR, 2 PEOPLE
COLLECTION SYSTEM WELLS	1	LS	2000	2,000	CLEAN EVERY 10 YRS. - 4 WKS. LABOR, 2 PEOPLE
CAP REPAIRS					
EROSION CONTROL	74	AC	225	16,650	
FREEZE/THAW REPAIRS	74	AC	225	16,650	
SETTLEMENT REPAIRS	9400	CY	10	94,000	FILL 2" SETTLEMENT OVER 50% OF LANDFILL YEARLY
FENCE MAINTENANCE	1	LS	3600	3,600	
MOWING	74	AC	670	49,580	
CLEAN TILE SYSTEM					CLEAN PIPELINE EVERY 5 YEARS
LEACHATE COLLECTION SYSTEM - NSL	5720	LF	0.5	2,860	
GROUNDWATER ISOLATION SYSTEM	5500	LF	0.5	2,750	
GROUNDWATER COLLECTION SYSTEM - ECC	5400	LF	0.5	2,700	

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE ASSUMED TO BE IN RCRA LANDFILL.
   NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. PACT CARBON SOLIDS ASSUMED TO BE DISPOSED OF IN RCRA LANDFILL. IF REGULATIONS REQUIRE INCINERATION
   ADDITIONAL COSTS ARE ASSUMED TO BE $0.50 /lb OF PACT CARBON SOLIDS
   COST (YEARS 1 TO 5): $253,000 /YEAR
   COST (YEARS 5 TO 15): $72,000 /YEAR
   COST (YEARS 15 TO 30): $22,000 /YEAR

APPENDIX TABLE A-28 PAGE 1

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 8: ACCESS RESTRICTIONS WITH RCRA CAP, GROUNDWATER ISOLATION/COLLECTION, LEACHATE COLLECTION AND TREATMENT
SOIL INCINERATION AND CONSOLIDATION AT ECC

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$66,423,000			$66,423,000
1		$1,331,000	0.90909	$1,209,999
2		$1,102,000	0.82645	$910,748
3		$1,108,300	0.75131	$832,677
4		$1,102,000	0.68301	$752,677
5		$1,113,910	0.62092	$691,649
6		$893,300	0.56447	$504,241
7		$887,000	0.51316	$455,173
8		$887,000	0.46651	$413,794
9		$893,300	0.4241	$378,849
10		$906,910	0.38554	$349,650
11		$887,000	0.35049	$310,885
12		$893,300	0.31863	$284,632
13		$887,000	0.28966	$256,928
14		$887,000	0.2[illegible]333	$233,574
15	$399,000	$905,210	0.23939	$312,215
16		$714,000	0.21763	$155,388
17		$714,000	0.19784	$141,258
18		$720,300	0.17986	$129,553
19		$714,000	0.16351	$116,746
20		$733,910	0.14864	$109,088
21		$720,300	0.13513	$97,334
22		$714,000	0.12285	$87,715
23		$714,000	0.11168	$79,740
24		$720,300	0.10153	$73,132
25		$725,910	0.0923	$67,001
26		$714,000	0.0[illegible]91	$59,912
27		$720,300	0.07628	$54,944
28		$714,000	0.06934	$49,509
29		$714,000	0.06304	$45,011
30	$8,985,000	$740,210	0.05731	$557,352

TOTAL O&M PRESENT WORTH	$9,111,000
TOTAL REPLACEMENT PRESENT WORTH	$610,000
TOTAL PRESENT WORTH	$76,144,000

NOTES:

1. DISPOSAL OF PRECIPITATION SLUDGE TO BE IN A RCRA LANDFILL. NO FIXATION OF THE SLUDGE ASSUMED TO BE REQUIRED.

2. IF INCINERATION OF PACT SOLIDS AT $ 0.50 / LB. IS REQUIRED, THE ADDITIONAL PRESENT WORTH (WHICH IS NOT INCLUDED) IS : $1,201,000

   THE PRESENT WORTH OF THE PACT SOLIDS DISPOSAL IN A RCRA LANDFILL, TO BE SUBTRACTED FROM THE TOTAL PRESENT WORTH IS : $96,000

ANNUAL O & M COSTS:

ANNUAL COSTS	FIRST YEAR	AFTER FIRST YEAR
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	30,800
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
$/YR	$347,000	$118,000

ANNUAL COSTS (SAME EVERY YEAR, $/YR)	
INSPECTION	3,600
GEN. MAINTENANCE	
CAP REPAIRS	127,300
FENCE MAINTENANCE	2,600
MOWING	49,580
PUMP ELECTRICITY	
LEACHATE COLLECTION SYSTEM	1,000
GROUNDWATER ISOLATION SYSTEM	6,000
GROUNDWATER COLLECTION SYSTEM -ECC	650
TOTAL ANNUAL COSTS ($/YEAR)	$192,000

NONANNUAL MAINTENANCE ($/ACTIVITY)	
REFURBISH SCREENS (EVERY 10 YEARS)	
MONITORING WELLS	$6,000
COLLECTION SYSTEM WELLS	$2,000
GROUNDWATER/LEACHATE COLLECTION	
PUMP REPLACEMENT	
EJECTOR REPLACEMENT (EVERY 3 YEARS)	$6,300
FRENCH DRAIN (EVERY 5 YEARS)	$1,000
LEACHATE COLLECTION (EVERY 5 YEARS)	$500
GROUNDWATER COLLECT-ECC(EVERY 5 YRS)	$2,100
CLEAN TILE SYSTEM (EVERY 5 YEARS)	
LEACHATE COLLECTION SYSTEM	$2,860
GROUNDWATER ISOLATION SYSTEM	$2,750
GROUNDWATER COLLECTION SYSTEM -ECC	$2,700

TREATMENT SYSTEM FLOW RATE @ 341 GPM - FIRST 5 YEARS	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	79,650
SLUDGE DISPOSAL	141,600
CHEMICAL USAGE	
FERROUS SULFATE	593
ALKALI	38,925
POLYMER	9,983
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	11,355
SOLIDS DISPOSAL	20,240
CARBON USAGE	61,320
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$792,000

TREATMENT SYSTEM FLOW RATE @ 211 GPM - YEARS 5 TO 15	
INFLUENT PUMPING	
ELECTRICITY	980
PRECIPITATION SYSTEM	
ELECTRICITY	327
SLUDGE HAULING	36,675
SLUDGE DISPOSAL	65,200
CHEMICAL USAGE	
FERROUS SULFATE	407
ALKALI	18,690
POLYMER	6,164
PACT SYSTEM	
ELECTRICITY	38,500
SOLIDS HAULING	[illegible]
SOLIDS DISPOSAL	[illegible]
CARBON USAGE	[illegible]
AIR COMPRESSOR	
ELECTRICITY	8,200
MAINTENANCE	250,560
SUPERVISION	93,960
MONITORING	33,600
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	[illegible]

TREATMENT SYSTEM FLOW RATE @ 6 GPM - AFTER 15 YEARS	
INFLUENT PUMPING	
ELECTRICITY	164
PRECIPITATION SYSTEM	
ELECTRICITY	[illegible]
SLUDGE HAULING	[illegible]
SLUDGE DISPOSAL	[illegible]
CHEMICAL USAGE	
FERROUS SULFATE	[illegible]
ALKALI	1,590
POLYMER	157
PACT SYSTEM	
ELECTRICITY	[illegible]
SOLIDS HAULING	[illegible]
SOLIDS DISPOSAL	[illegible]
CARBON USAGE	[illegible]
AIR COMPRESSOR	
ELECTRICITY	[illegible]
MAINTENANCE	[illegible]
SUPERVISION	[illegible]
MONITORING	[illegible]
SAMPLE SHIPPING CHARGES	2,400
OPERATING COST	$404,[illegible]

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 9: ACCESS RESTRICTIONS WITH RCRA LANDFILL

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST	ASSUMPTIONS
DIRECT CAPITAL COSTS						
1. REMOVE CREEK AND LEACHATE SEDIMENT						
EXCAVATE	4200	CY	8	33,600		EXCAVATE SAND & GRAVEL (WET)
BACKFILL EXCAVATION						
MATERIAL	4000	CY	10	40,000		CLAY BACKFILL
PLACEMENT	4000	CY	5	20,000		300' HAUL, 4" LIFTS, 4 PASSES
ESTABLISH VEGETATIVE COVER						
SOIL	6800	CY	5	34,000		ONSITE TILL, EXCAVATE, HAUL, BACKFILL
HYDROSEED	61200	SF	0.03	1,836		HYDRAULIC SPREADER
SUBTOTAL					$129,000	
2. REROUTE FINLEY CREED AND UNNAMED DITCH						4300 FT. REROUTED
EXCAVATE NEW CREEK BED	3255	CY	20	65,100		TILL, EXCAVATE AND HAUL
RIPRAP	540	CY	74	39,960		
SUBTOTAL					$105,000	
3. MONITORING PROGRAM						
MONITORING WELLS						
11 - UPPER GLACIAL TILL	320	LF	60	19,200		SHALLOW - HOLLOW STEM AUGER
13 - MID-DEPTH	490	LF	60	29,400		
2 - DEEP SAND AND GRAVEL	350	LF	75	26,250		DEEP, DOUBLE CASING, TILL WELL ADJACENT TO N. DEEP WELL
PIEZOMETERS						
2 - UPPER GLACIAL TILL	40	LF	60	2,400		SHALLOW - HOLLOW STEM AUGER
2 - MID-DEPTH	70	LF	60	4,200		
SUBTOTAL					$81,000	
4. CONSTRUCTION OF RCRA LANDFILL						
A. SITE PREPARATION						
CLEAR & GRUB WOODS	25	Ac	1250	31,250		EQUIVALENT OF 25 ACRES OF WOODED AREA OVER SITE
CLEAR MEDIUM BRUSH	430000	SY	0.36	154,800		
EXCAVATION	1900000	CY	3.43	6,517,000		EXCAVATION FROM DTM PROGRAM, ELEV 900
PRELIM. SITE GRADING	430000	SY	0.71	305,300		FINE GRADE
COMPACT SUBGRADE	280000	CY	1.81	506,800		THREE PASSES
SUBTOTAL					$7,515,000	
B. BERM CONSTRUCTION						
FILL						
REQUIRED VOLUME	1800000	CY				THESE VALUES ARE FROM A CUT AND FILL CALCULATION
AVAILABLE VOLUME (FROM EXCAV)	1900000	CY				PROGRAM, DTM
IMPORT VOLUME	-52000	CY	10.55	(548,600)		
PLACE AND COMPACT	1800000	CY	2.75	4,950,000		
TOPSOIL	47000	CY	5	235,000		
HYDROSEEDING	1260000	SF	0.03	37,800		FESCUE, HYDRAULIC SPREADER
SUBTOTAL					$4,674,000	
C. RCRA MULTILAYER LINER						
1 FT. SAND						
EXCAVATE & HAUL	86000	CY	8	688,000		
BACKFILL	86000	CY	3	258,000		
2 FT. CLAY						
EXCAVATE & HAUL	210000	CY	10	2,100,000		
BACKFILL	210000	CY	3	630,000		
GEOTEXTILE	620000	SY	1.5	930,000		TREVIRA
SYNTHETIC MEMBRANE	310000	SY	1.8	558,000		30 mil PVC
LEAK DETECTION, COLLECTION SYSTEM	86000	SY	0.80	68,800		
1 FT. SAND						
EXCAVATE & HAUL	86000	CY	8	688,000		
BACKFILL	86000	CY	3	258,000		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 9: ACCESS RESTRICTIONS WITH RCRA LANDFILL

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
GEOTEXTILE	620000	SY	1.5	930,000		TREVIRA
SYNTHETIC MEMBRANE	310000	SY	1.8	558,000		30 mil PVC
LEACHATE COLLECTION, REMOVAL SYSTEM	86000	Ac	1.80	154,800		
1 FT. SAND						
EXCAVATE & HAUL	86000	CY	8	688,000		
BACKFILL	86000	CY	3	258,000		
SUBTOTAL					$8,768,000	
D. MOVE EXISTING CONTAMINATED SOIL AND LANDFILL CONTENTS						ADD 30 % TO HANDLING COSTS FOR H&S
MOBILE TESTING LAB	1	LS	8000	8,000		FRONT-END SETUP COST. USE EPA EQUIPMENT
EXCAVATION	4100000	CY	1.4	5,740,000		2.5 CY FRONT END LOADER (1 DOZER PER LOADER)
TRANSPORTATION	4100000	CY	2	8,200,000		20 CY DUMP TRAILER
PLACEMENT/COMPACTION	4100000	CY	1.6	6,560,000		SHEEPSFOOT ROLLER (1 DOZER PER 2 ROLLERS)
SUBTOTAL					$20,508,000	
E. BACKFILL EXCAVATED LANDFILL						
BACKFILL LANDFILL TO LINER ELEVATION	280000	CY	6	1,680,000		COMMON FILL TO ELEVATION 910
BACKFILL SITE OF SOIL EXCAVATION						FILL TO EXISTING ELEVATION, SOUTH SIDE OF LANDFILL
BACKFILL	1700000	CY	6	10,200,000		COMMON FILL
TOPSOIL	56467	CY	5	282,333		
HYDROSEED	1524600	SF	0.03	45,738		FESCUE, HYDRAULIC SPREADER
SUBTOTAL					$12,208,000	
F. RCRA MULTILAYER CAP						
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	96000	CY	8	768,000		
BACKFILL	96000	CY	3	288,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	190000	CY	10	1,900,000		
BACKFILL	188148	CY	3	564,444		
GEOTEXTILE	580000	SY	1.5	870,000		2 LAYERS OF POLYPROPYLENE
SYNTEHTIC MEMBRANE	290000	SY	1.8	522,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	96000	CY	8	768,000		
BACKFILL	96000	CY	3	288,000		
ESTABLISH VEGETATIVE COVER						
TOPSOIL	96000	CY	5	480,000		ONSITE TILL, EXCAVATE, HAUL, AND BACKFILL
HYDROSEED	2610000	SF	0.03	78,300		FESCUE, HYDRAULIC SPREADER
SUBTOTAL					$6,527,000	
RCRA LANDFILL SUBTOTAL					$60,200,000	
5. ACCESS RESTRICTIONS						
FENCING	8700	LF	12	104,400		6' CHAIN LINK WITH BARBED WIRE
GATE	2	EA	2000	4,000		
SIGNAGE	60	EA	33	1,980		1 SIGN EVERY 150 FT. ALONG FENCE
SUBTOTAL					$110,000	
CONSTRUCTION SUBTOTAL					$60,625,000	
6. CONTINGENCIES						
MOBILIZATION/DEMOBILIZATION (7 %)				4,244,000		
HEALTH AND SAFETY (5 %)				3,031,000		
BID CONTINGENCIES (15 %)				9,094,000		
SCOPE CONTINGENCIES (35 %)				21,219,000		
CONSTRUCTION TOTAL					$98,213,000	
7. OTHER						

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 9: ACCESS RESTRICTIONS WITH RCRA LANDFILL

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
DIRECT CAPITAL COSTS						
PERMITTING (5 %)				4,911,000		
SERVICES DURING CONSTRUCTION				700,000		
TOTAL IMPLEMENTATION COST					$103,824,000	
8. ENGINEERING						
ENGINEERING DESIGN COST				1,000,000		
TOTAL CAPITAL COST					$104,824,000	

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 9: ACCESS RESTRICTIONS WITH RCRA LANDFILL

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST		ASSUMPTIONS
REPLACEMENT COSTS						
1. RCRA MULTILAYER CAP REPLACEMENT						REPLACEMENT AT 30 YEARS
DRAINAGE LAYER						1.5 FT. THICK SAND AND GRAVEL, COMPACTED
EXCAVATE & HAUL	96000	CY	8	768,000		
BACKFILL	96000	CY	3	288,000		
CLAY LAYER						2 FT. THICK, COMPACTED
EXCAVATE & HAUL	190000	CY	10	1,900,000		
BACKFILL	188148	CY	3	564,444		
GEOTEXTILE	580000	SY	1.5	870,000		2 LAYERS OF POLYPROPYLENE
SYNTENTIC MEMBRANE	290000	SY	1.8	522,000		30 MIL. PVC
SAND LAYER						USE ONSITE SOIL (COMMON EARTH)
EXCAVATE & HAUL	96000	CY	8	768,000		
BACKFILL	96000	CY	3	288,000		
ESTABLISH VEGETATIVE COVER						
SOIL	96000	CY	5	480,000		ONSITE TILL, EXCAVATE, HAUL, AND BACKFILL
HYDROSEED	2610000	SF	0.03	78,300		FESCUE, HYDRAULIC SPREADER
SUBTOTAL (TO NEAREST $1000)					$6,527,000	

APPENDIX TABLE A-31

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 9: ACCESS RESTRICTIONS WITH ONSITE RCRA LANDFILL

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST FIRST YEAR	TOTAL COST AFTER FIRST YEAR	ASSUMPTIONS
DIRECT OPERATION AND MAINTENANCE COSTS						
1. MONITORING ($/SAMPLING ROUND)						QUARTERLY FOR 1ST YR., SEMI-ANNUALLY THEREAFTER FOR GROUNDWATER, OTHERS SEMI-ANNUALLY
MONITORING WELLS	41	EA	1400	229,600	30,800	14 WELLS AFTER FIRST YEAR, $1100/WELL
LABOR FOR MONITORING WELLS	6	DAY	1000	24,000	12,000	1 E1, 2 TECH'S 6 DAYS
SURFACE WATER	8	EA	1400	22,400	22,400	1 E1, 2 TECH'S 6 DAYS
SEDIMENT	8	EA	1600	25,600	25,600	
LABOR FOR SURFACE SAMPLES	1	DAY	600	1,200	1,200	1 E1, 1 TECH, 1 DAY , SEMI-ANNUALLY
AIR QUALITY MONITORING	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
FIELD BLANKS	1	LS	700	1,400	1,400	Hnu, OVa - 1 E3, 1 TECH, 1 DAY , SEMI-ANNUALLY
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	$1100/WELL AFTER 1 YEAR
SEDIMENT	1	EA	1600	3,200	3,200	
DUPLICATES	1	EA	1600	3,200	3,200	
GROUNDWATER	2	EA	1400	11,200	4,400	$1100/WELL AFTER 1 YEAR
SURFACE WATER	1	EA	1400	2,800	2,800	$1100/WELL AFTER 1 YEAR
SEDIMENT	1	EA	1600	3,200	3,200	
SHIPPING CHARGES	1	LS	2000	8,000	4,000	3 SAMPLES/COOLER - $100/COOLER
2. SAMPLING DURING EXCAVATION ($/YEAR)						
LABOR FOR SOIL SAMPLING	1	LS	38400	38,400		1 TECH. FULL TIME, FIRST 5 YEARS
LABORATORY TECHNICIAN	1	LS	76800	76,800		2 TECH'S FULL TIME, FIRST 5 YEARS
3. INSPECTION ($/YEAR)						
SITE INSPECTION	1	LS	1800	3,600		1 E1, 1 TECH, 3 DAYS, TWICE PER YEAR
4. OTHER MAINTENANCE ($/YEAR)						
REFURBISH WELL SCREENS						
MONITORING WELLS	1	LS	5000	5,000		CLEAN EVERY 10 YRS. 2 WEEKS LABOR, 2 PEOPLE
CAP REPAIRS (ANNUAL)						
EROSION CONTROL	85	AC	225	19,125		
FREEZE/THAW REPAIRS	85	AC	225	19,125		
MOWING	85	AC	670	56,950		
FENCE MAINTENANCE	1	LS	3600	3,600		
CAP REPAIRS ($/REPAIR)						EVERY 10 YEARS
FINE SURFACE GRADING	280720	SY	1	280,720		

COMBINED ALTERNATIVE ANALYSIS - ALTERNATIVE 9: ACCESS RESTRICTIONS WITH RCRA LANDFILL

PRESENT WORTH (BASED ON ANNUAL CAPITAL COST) ANALYSIS

YEAR	ANNUAL CAPITAL COST $	ANNUAL O&M COST $	DISCOUNT RATE 10%	PRESENT WORTH
0	$104,824,000			$104,824,000
1		$564,000	0.90909	$512,727
2		$335,000	0.82645	$276,861
3		$335,000	0.75131	$251,689
4		$335,000	0.68301	$228,808
5		$335,000	0.62092	$208,008
6		$220,000	0.56447	$124,183
7		$220,000	0.51316	$112,895
8		$220,000	0.46651	$102,632
9		$220,000	0.4241	$93,302
10		$506,720	0.38554	$195,361
11		$220,000	0.35049	$77,108
12		$220,000	0.31863	$70,099
13		$220,000	0.28966	$63,725
14		$220,000	0.26333	$57,933
15		$220,000	0.23939	$52,666
16		$220,000	0.21763	$47,879
17		$220,000	0.19784	$43,525
18		$220,000	0.17986	$39,569
19		$220,000	0.16351	$35,972
20		$506,[illegible]	0.14864	$75,319
21		$220,000	0.13513	$29,729
22		$220,000	0.12285	$27,027
23		$220,000	0.11168	$24,570
24		$220,000	0.10153	$22,337
25		$220,000	0.0923	$20,306
26		$220,000	0.08391	$18,460
27		$220,000	0.07628	$16,782
28		$220,000	0.06934	$15,255
29		$220,000	0.06304	$13,869
30	$6,527,000	$506,720	0.05731	$403,102
TOTAL O&M PRESENT WORTH				$2,888,000
TOTAL REPLACEMENT PRESENT WORTH				$374,000
TOTAL PRESENT WORTH				$108,086,000

ANNUAL COSTS	FIRST YEAR	AFTER FIRST YEAR
MONITORING ($/SAMPLING ROUND)		
MONITORING WELLS	229,600	30,800
LABOR - MONITORING WELLS	24,000	12,000
SURFACE WATER	22,400	22,400
SEDIMENT	25,600	25,600
LABOR - SURFACE SAMPLES	1,200	1,200
AIR QUALITY MONITORING	1,400	1,400
FIELD BLANKS		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,800
SEDIMENT	3,200	3,200
DUPLICATES		
GROUNDWATER	11,200	4,400
SURFACE WATER	2,800	2,900
SEDIMENT	3,200	3,200
SHIPPING CHARGES	8,000	4,000
EXCAV. SAMPLING (1ST 5 YRS)	115,200	
$/YR (QUARTERLY - 1ST YEAR)	$452,000	
$/YR (SEMI-ANNUALLY YEARS 2 THRU 5)	$233,000	
$/YR (SEMI-ANNUALLY AFTER 5 YEARS)	$118,000	
ANNUAL COSTS (SAME EVERY YEAR, $/YR)		
INSPECTION	3,600	
GEN. MAINTENANCE		
CAP MAINTENANCE	38,250	
FENCE MAINTENANCE	3,600	
MOWING	56,950	
TOTAL ANNUAL COSTS ($/YEAR)	$102,000	
NONANNUAL MAINTENANCE ($/ACTIVITY)		
RCRA CAP		
CAP REPAIRS (EVERY 10 YEARS)	$280,720	
MONITORING SYSTEM		
REFURBISH SCREENS (EVERY 10 YEARS)	$6,000	

Appendix B
DISTRIBUTION OF ALTERNATIVE COSTS BETWEEN ECC AND NSL

Appendix B
DISTRIBUTION OF ALTERNATIVE COSTS BETWEEN ECC AND NSL

Distribution of CAA Alternative costs between ECC and NSL was included for purposes of cost recovery. During negotiations with potential responsible parties (PRP's) or during possible court action, EPA will need to assign remedial action costs to ECC PRP's and to NSL PRP's. The cost breakdowns presented here are believed to be based on a reasonable methodology, given the existing data and understanding of the site. Distribution of costs for the selected remedial action should be re-evaluated following final design since additional data on the site and more accurate cost estimates will be available at that time.

The methodology for distribution of costs of the CAA alternatives between ECC and NSL are discussed below for each alternative. Where components appear in more than one alternative, the cost breakdown is discussed only for the first alternative in which it appears. Cost items referred to in this appendix are presented in the detailed cost tables of Appendix A.

Costs were distributed to the two sites based on the physical dimensions of the sites. Costs of components remediating groundwater contamination in the southwestern corner of the site, where the contaminant source could be either ECC or NSL, were divided equally between the sites.

Contingency estimates are applied at the same percentage used for the CAA alternative unless noted otherwise. Services during construction and engineering design costs are distributed based on the site's proportion of the CAA construction total, unless noted otherwise.

ALTERNATIVE 2

1. STABILIZE LAND SURFACE

Preliminary Grading on NSL. Grading is limited to NSL. 100 percent of cost assigned to NSL.

Runoff Control. Construction of new ditches is entirely on NSL. 100 percent of cost assigned to NSL.

Soil and Vegetative Cover. Area of cover includes ECC and NSL. Distribute cost based on area of sites. ECC area equals 3.6 acres. NSL area equals 70 acres. Assign 5 percent of cost to ECC and 95 percent to NSL.

Access Roads. Access road improvements limited to NSL. 100 percent of cost assigned to NSL.

2. REMOVE CREEK AND LEACHATE SEDIMENT

All sediment removed is upgradient of ECC and, therefore, is attributable to NSL. 100 percent of cost assigned to NSL.

3. REROUTE FINLEY CREEK AND UNNAMED DITCH

Cost of relocating unnamed ditch from between the sites is split equally between ECC and NSL. Also, relocation of 600-foot section of Finley Creek south of ECC is split equally between the sites. The remaining 1,600 feet is assigned to NSL. This results in 26 percent of cost assigned to ECC and 74 percent to NSL.

4. MONITORING PROGRAM

Capital Costs. Installation costs of four monitoring wells assigned to ECC (two wells onsite and two wells immediately west of the site). Costs of five wells south of ECC split equally with NSL. The remaining 17 wells and 4 piezometers are assigned to NSL. Results in 12 percent of cost assigned to ECC and 88 percent to NSL.

Operation and Maintenance. Sampling and analysis costs for five monitoring wells assigned to ECC. Sampling and analysis cost of five wells south of ECC split equally between ECC and NSL. Costs associated with the remaining 31 wells assigned to NSL. Eighteen percent of groundwater monitoring cost assigned to ECC and 82 percent to NSL.

Sampling and analysis costs of six surface water and sediment locations split equally between ECC and NSL. Costs of two remaining locations assigned to NSL. This results in 38 percent of costs assigned to ECC and 62 percent to NSL.

Air monitoring costs split equally between ECC and NSL.

These breakdowns result in 24 percent of the monitoring program operation and maintenance cost assigned to ECC and 76 percent to NSL.

5. LEACHATE COLLECTION SYSTEM

Leachate collection system is attributable solely to NSL.

6. LEACHATE TREATMENT

Leachate treatment is attributable solely to NSL.

7. ACCESS RESTRICTIONS

Costs distributed based on linear feet of fence. Length of fence on north, west, and south boundary of ECC is 1,300 feet. Total fence length is 9,300 feet. Assign ECC 14 percent of cost and NSL 86 percent.

CONTINGENCIES AND INDIRECT COSTS

Distributed as per general methodology discussed earlier.

<u>ALTERNATIVE 3</u>

(See Alternative 2 for duplicate components)

3. ECC SITE WORK

ECC site work is attributable solely to ECC.

5. RCRA CAP CONSTRUCTION

<u>Preliminary Grading</u>. Preliminary grading on NSL only. Cost is 100 percent attributable to NSL.

<u>Cap Construction</u>. Cost of gas collection layer is 100 percent attributable to NSL, because it is not needed at ECC. Remainder of cap construction cost is distributed based on cap area. ECC assigned 5 percent of remaining cost and NSL 95 percent, per respective site areas (see Alternative 2; 1. Stabilize Land Surface).

<u>Vegetative Cover</u>. ECC assigned 5 percent of cost and NSL 95 percent.

<u>ALTERNATIVE 4</u>

(See Alternatives 2 and 3 for duplicate components)

5. MONITORING PROGRAM

<u>Capital Costs</u>. See Alternative 2.

<u>Operation and Maintenance Costs</u>. Sampling and analysis costs of groundwater monitoring the same as Alternative 2 for year 1. Costs for years 2 through 30 assigned as follows: one well assigned to ECC (west of site) and five wells (four wells south of site and one background well) split equally between sites. Remaining eight wells assigned to NSL. This results in 25 percent of groundwater monitoring costs assigned to ECC and 75 percent to NSL for years 2 through 30. Surface water, sediment and air monitoring costs assigned

as in Alternative 2. Resulting operation and maintenance costs of overall monitoring program result in ECC with 31 percent of cost and NSL 69 percent.

6. GROUNDWATER INTERCEPTION

Costs associated with two of the six extraction wells assigned to ECC (located near southwest corner of ECC). Costs of next two wells south of ECC split equally between the sites. Remaining two wells assigned to NSL. French drain interception south of NSL assigned to NSL. This results in 10 percent of costs of groundwater interception assigned to ECC and 90 percent to NSL.

8. GROUNDWATER COLLECTION - ECC

All costs assigned to ECC.

9. GROUNDWATER/LEACHATE TREATMENT

Several methodologies were considered for distribution of treatment costs.

Methodologies involving assigning cost based on treatment flowrate or contaminant loading rates were considered but rejected for the following reasons:

- o A portion of contaminated groundwater from NSL may migrate beneath ECC and pick up additional contaminants, making it difficult to assign contaminant loading rates to one site or the other.

- o Contaminated groundwater in the southwest portion of the site may be from either site. Assigning contaminant loading or flowrates between the sites is difficult in this area.

- o Treatment of ECC groundwater was considered necessary for organics removal only in the ECC FS Report, while NSL groundwater requires metals and organics removal. Assignment of all metals removal costs to NSL would be appropriate. However, since the ECC groundwater becomes comingled with NSL contaminated groundwater prior to entering the collection system, treatment for metals removal is necessary for flow from both sites. Technical justification for assignment of this additional cost to ECC or NSL is not clear.

- o Capital and operation and maintenance costs for removal of organics is higher on a per gallon basis for the PACT system versus the GAC system considered appropriate for ECC groundwater in the ECC FS Report. Using the unit cost of organics removal for the PACT system for removal of organics originating from ECC would result in an excessive cost assigned to ECC.

Because of these considerations it was decided a more simplistic but reasonably equitable distribution of costs was justifiable. This method involves assigning costs of the CAA treatment system in the same proportion as the costs of treatment systems considered appropriate in the respective ECC and NSL FS's.

Capital Costs. The capital cost of groundwater treatment for ECC FS Alternative 4 is $157,000. The capital cost of groundwater and leachate treatment of NSL Alternative 4 is $1,803,000. The ECC cost is 8 percent of the summed costs of treatment and NSL is 92 percent. These percents are then applied to the CAA treatment system costs.

Operation and Maintenance. The annual average operation and maintenance cost of groundwater treatment for ECC FS Alternative 4 is $78,000. The cost of NSL Alternative 4 treatment is $658,000. The ECC operation and maintenance cost is 11 percent of the summed total and NSL is 89 percent.

ALTERNATIVE 5

(See Alternatives 2, 3, and 4 for duplicate components)

5. RCRA CAP CONSTRUCTION

Cap Construction. Cost of gas collection layer is 100 percent attributable to NSL. Remainder of cap construction cost is distributed based on cap area as in Alternative 3. Cost of additional 3 acres of cap to the south of ECC in Alternative 5 is split equally between ECC and NSL. This results in 7 percent of total cap cost assigned to ECC and 93 percent to NSL.

6. GROUNDWATER INTERCEPTION

Costs associated with 300 feet of intercepting drain assigned to ECC (Section nearest ECC). Cost of next 300 feet split equally with NSL. Remaining 2,500 feet south of NSL assigned to NSL. This results in 15 percent (450 feet/3,100 feet) of cost assigned to ECC and 85 percent to NSL.

8. GROUNDWATER/LEACHATE TREATMENT

Capital and operation and maintenance costs distributed as in Alternative 4. Capital cost distributed

8 percent to ECC and 92 percent to NSL. Operation and maintenance cost distributed 11 percent to ECC and 89 percent to NSL.

ALTERNATIVE 6

(See previous alternatives for duplicate components)

6. GROUNDWATER ISOLATION

Cost of French drains divided between sites based on length of drain. One thousand feet of drain to the north and west of ECC assigned to ECC. Seven hundred feet of drain south of ECC split equally between the sites. This results in 25 percent of the cost of drains assigned to ECC and 75 percent to NSL. Cost of extraction wells assigned solely to NSL. As a percent of total groundwater isolation costs, ECC was assigned 16 percent and NSL 84 percent.

9. GROUNDWATER/LEACHATE TREATMENT

Capital and operation and maintenance costs distributed as in Alternative 4. Capital cost distributed 8 percent to ECC and 92 percent to NSL. Operation and maintenance cost distributed 11 percent to ECC and 89 percent to NSL.

ALTERNATIVE 7

(See previous alternatives for duplicate components)

10. SOIL VAPOR EXTRACTION

Soil vapor extraction of ECC soils only. All costs assigned to ECC.

ALTERNATIVE 8

(See previous alternatives for duplicate components)

10. SOIL INCINERATION

Soil incineration of ECC soils only. All costs assigned to ECC.

<u>ALTERNATIVE 9</u>

(See previous alternatives for duplicate components)

4. RCRA LANDFILL

Cost of RCRA landfill divided based on excavated volume of contaminated soil or landfill contents. Volume of ECC-contaminated soil is 150,000 cubic yards. Total ECC and NSL volume is 4,400,000 cubic yards. ECC allocated 3 percent of total cost (150,000 cy/4,400,000 cy) and NSL 97 percent.

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Appendix C
GROUNDWATER COLLECTION SYSTEM ANALYSIS

INTRODUCTION

Detailed analyses of the groundwater system at the site are presented in the ECC FS (Appendix B: Groundwater Collection System Configuration Calculations) and the NSL FS (Appendix B: Groundwater Analysis). Estimates of flows for the combined alternatives were modified from the estimates in the ECC and NSL Feasibility Study reports.

ALTERNATIVE 2

The flow for Alternative 2 will be due to percolation through the landfill surface which will result in the generation of leachate. The leachate collection system for this or any of the combined alternatives does not extend around the ECC site. Therefore, the rate of leachate generation for this alternative will be the same as for NSL Alternative 2, or 40 gpm.

ALTERNATIVE 3

The flow for Alternative 3 will be due to drainage of leachate from the landfill for the first 5 years as the RCRA cap is constructed, and to percolation through the RCRA cap after 5 years. The flows will be the same as for NSL Alternative 3: 40 gpm for the first 5 years and 5 gpm after that.

ALTERNATIVE 4

The flow for Alternative 4 has three components:

- o Leachate generation through the landfill surface
- o Flow to a groundwater collection system along the south and southwest boundaries of the site
- o Flow to closely spaced French drains in the till unit above the sand and gravel lens at the ECC site.

The rate of leachate generation will be the same as for Alternative 2, or 40 gpm. The groundwater collection system will be similar to that for NSL Alternative 4. The configuration of the French drain along the south boundary of the site will be the same as for NSL Alternative 4, and therefore the flow to the drain will be the same (23 gpm). Groundwater extraction from the sand and gravel lens at the southwest portion of the site can be accomplished using the six wells pumping at 11 gpm each included in NSL Alternative 4, except that the wells would be located southwest of the ECC site to intercept groundwater before it discharges to Finley Creek. The flowrate from the wells would be the same as for

NSL Alternative 4, or 66 gpm. A rate of 8 gpm was estimated in the ECC FS for flow to the closely spaced French drains.

The resulting total flow for Alternative 4 is approximately 140 gpm, which consists of 40 gpm from leachate generation, 90 gpm from the groundwater collection system, and 8 gpm from the French drains at the ECC site.

ALTERNATIVE 5

The flows for Alternative 5 have two components:

- Leachate generation through the landfill surface
- Flow to a groundwater collection system along the south and southwest boundaries of the site.

The rates of leachate generation will be the same as for Alternative 3: 40 gpm for the first 5 years as a RCRA cap is placed on the landfill surface and leachate drains from the landfill, and 5 gpm after the first 5 years.

The groundwater collection system will be similar to that in Alternative 4 with one exception. A subsurface drain will be used in the sand and gravel lens in the southwest portion of the site instead of extraction wells, and the south side of the drain will be lined with an impermeable barrier to minimize flow to the drain from Finley Creek. It is estimated that the flow to the drain without the barrier would be the same as to the extraction wells (66 gpm), but that placement of the barrier will cut the flow in half (to 33 gpm). Therefore, flow to the groundwater collection system in Alternative 5 would be approximately 60 gpm instead of the 90 gpm in Alternative 4.

The resulting flows for Alternative 5 will be 100 gpm for the first 5 years (40 gpm for leachate generation and 60 gpm from the groundwater collection system), and 65 gpm after 5 years (5 gpm from leachate generation and 60 gpm from the groundwater collection system).

ALTERNATIVE 6

The flows for Alternative 6 have three components:

- Leachate generation through the landfill surface
- Flow to a groundwater collection system around the periphery of the site
- Flow to closely spaced French drains in the till unit above the sand and gravel lens at the ECC site.

The rates of leachate generation will be the same as for Alternative 3: 40 gpm for the first 5 years as a RCRA cap is placed on the landfill surface and leachate drains from the landfill, and 5 gpm after the first 5 years.

The flow to the closely spaced French drains at the ECC site will be due to percolation through the RCRA cap. If it is assumed that percolation will occur at a rate of 1 in/yr ($0.0000012 \text{ gpm/ft}^2$) through a cap with an area of 6.5 Ac ($283, 140 \text{ ft}^2$), then the percolation rate, Q, can be estimated as:

$$
\begin{aligned}
Q &= (0.0000012 \text{ gpm/ft}^2)(283, 140 \text{ ft}^2) \\
&= 0.34 \text{ gpm}
\end{aligned}
$$

A value of 0.5 gpm was used for flow to the ECC French drains.

The flow to the groundwater collection system in Alternative 6 will be similar to that in NSL Alternative 6, except that the length of the French drain encircling the site will be approximately 450 feet longer so that the drain may extend around the ECC site. The drain extension will occur in materials that are hydrogeologically similar to those in drain segment 6 of NSL Alternative 6.

Drain segment 6 is approximately 1,000 feet long and has an estimated total flow of 67 gpm, or 0.067 gpm/ft. If the segment is extended 450 feet, then the increase in flow, dQ, over that estimated for NSL Alternative 6 will be:

$$
dQ = (450 \text{ ft})(0.067 \text{ gpm/ft}) = 30 \text{ gpm}
$$

Therefore, the flow to the groundwater collection system in Alternative 6 will be 30 gpm greater than that estimated for NSL Alternative 6, or approximately 200 gpm. The flowrate to the groundwater collection system while the water table beneath the site is being lowered will be the same as for NSL Alternative 6, or approximately 100 gpm.

The resulting flows for Alternative 6 will be 340.5 gpm for the first 5 years (40 gpm from leachate generation, 0.5 gpm from the ECC French drains, 100 gpm from the lowering of the water table beneath the site, and 200 gpm from the groundwater collection system), and 205.5 gpm after 5 years (5 gpm from leachate generation, 0.5 gpm from the ECC French drains, and 200 gpm from the groundwater collection system).

ALTERNATIVES 7 AND 8

Flows for Alternatives 7 and 8 will be the same as for Alternative 6.

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